NUCLEAR SCIENCE ABSTRACTS

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GENERAL

2099 BNL-314
Brookhaven National Lab.
QUARTERLY PROGRESS REPORT [FOR] JULY 1–SEPTEMBER 30, 1954. (UNCLASSIFIED SECTION). 62p.

Unclassified research progress is reported. Abstracts and appropriate journal numbers are given for research activities being reported concurrently in the scientific journals. Cosmotron research and operation. Measurements of the proton-proton elastic scattering angular distributions are in progress. The study of K mesons is continuing. A pentane bubble chamber with a volume of 500 cc has been put into operation. A counter experiment is in progress to detect γ rays which originate from heavy mesons or hyperons. The polarization of nucleons elastically scattered from nuclei has been calculated for the nuclear potential of Woods and Saxon. It was found that the magnets of the Cosmotron have settled during the past 2 years, and betatron oscillations of the beam have increased by about ½ in. Tests have shown that it will be possible to extract 50% of the internal circulating protons and have these particles available in a concentrated beam. Accelerator development. Development work on all phases of the 25 bev alternating gradient synchrotron is continuing. Construction of the electron analog is progressing rapidly. Reactor research and operation. Reactor facilities continued to be operated at almost capacity level. The new automatic control system for the crystal spectrometer is in operation, and data are recorded directly on punched cards. Emphasis in the total cross-section program has been shifted to detailed measurements of individual resonances of special interest. Scattering data runs on the 1.260 ev resonance in Rh were completed. Preliminary work has been performed in connection with the use of the Columbia Univ. crystal spectrometer for the determination of the nonmagnetic neutron-elastic interaction, for precise scattering measurements, and for the determination of the effect of molecular binding on the proton cross section at long neutron wavelengths. The shape of the β-ray spectrum of He^6 is being reinvestigated to determine the relative magnitude of the coupling constants in the β-decay interaction. Neutron diffraction analyses are being performed to ascertain the nature of the magnetic interaction of magnetic perovskites and the magnetic ordering of NiO. Meteorology. Sampling units for the oil fog sampling program are ready for field operations. Accurate records of wind fluctuations were obtained from 2 hurricanes. Soil temperature measurements are being obtained for the new accelerator sits. Nuclear Engineering Development work is reported on several special radioisotopes including I^{133}, Y^{90}, and F^{18}. It was found that particles must traverse a certain minimum distance in a proportional counter in order to be detected. A polarographic determination of Zr was carried out in aqueous solution. Production of I^{132} is now entering the routine phase. A process for making small beads of Y^{90} has been set up. Polaroid self-developing film has been found to be practical for rapid radiography when fine detail is not required. A process has been devised for producing extremely high β-radiation levels, and sources 2 to 3 mm in diameter can be made with fission product Sr^{90}. Work is continuing on the removal of fission products from waste solutions. Mixed fission products can be removed in the presence of boric acid by ion exchange on montmorillonite clay. Polymerization studies are continuing. Heat transfer rates between hot Hg drops and water are being measured in a spray column. Instrumentation. Instruments developed include a current indicator and integrator for use with a Van de Graaff generator, a pair spectrometer utilizing a gray wedge pulse-height analyzer, and a nonoverloading pulse amplifier for scintillation counting. Health Physics. A dosimetric study has been made of an experimental arrangement for exposing rats to thermal neutrons from a reactor. A facility for calibration of high range instruments has been set up. A test has shown that it is feasible to use active concentrate from the liquid waste evaporation plant in mixing concrete for sea disposal. Biology. Drosophila fed on a medium containing EDTA showed a significant increase in chromosome rearrangements. Results of studies on Tradescantia microspores suggest that x-ray breakage of chromosomes is dependent upon the condition of the chromosomal material at the time of irradiation. Work on the characterization and identification of the toxin produced in rate by x irradiation has continued and been reconfirmed. Medicine. Potassium thiocyanate decreased and low iodine diet enhanced the accumulation of At^{211} by rat thyroid gland. Preliminary data are presented on studies of the rate of incorporation of S^{35}-labeled methionine in the chick embryo; the distribution of I^{131} and I^{131}-labeled thyroxine and triiodothyroxine in rabbit brain; the incorporation of C^{14}-labeled amino acids in Trichinella larvae; tetanus antitoxin formation by young and old thymus tissues; the reaction of At with protein; tracer studies of the metabolism of glycerides and the composition of liver lipids in rats; the nephrotic syndrome in children; development of a method for the assay of acetylcholinesterase in tissues; the metabolism of I^{131} in humans; the effects of complexing agents on the absorption and distribution of Mn^{56}; response of skin to neutrons; a technique for in vivo evaluation of K^{42} transport in the heart and brain; tracer studies of Na and K transport across cell surfaces in human erythrocytes; survival of E. coli following exposure to slow neutrons; and methods for implanting tumor tissue to the lung. (For preceding period see BNL 299.) (M.P.G.)

2100 TID-5001 (1st Rev.)
Technical Information Service, AEC
SUBJECT HEADINGS USED IN THE CATALOGS OF THE UNITED STATES ATOMIC ENERGY COMMISSION. FIRST REVISED EDITION. Donald D. Davis, ed. Mar. 1955. 368p.

ATOMIC BOMBS AND WARFARE

2101

ELEVATED TANK DESIGNED TO WITHSTAND ATOMIC BLAST AT ONE HALF MILE. Iron Age 175, No. 5, 114-15 (1955) Feb. 3.

The design of a 500,000 gal elevated tank capable of withstanding an atomic blast equal to 20,000 tons of TNT at a ground zero distance of 0.5 miles is described. The tank is spherical to better resist large external pressures. In addition, it has more and stronger tubular columns of minimum diameter to reduce drag forces, and larger sway rods and heavier foundations than the conventional designs for wind or earthquake resistance. The necessity of a large mass of stored water to absorb the blast energy is briefly discussed. (J.A.G.)

ATOMIC POWER

2102

ATOMIC POWER IN AUSTRALIA. Presented at the Symposium on Atomic Power in Australia held at the New South Wales Univ. of Tech. on 31st August and 1st Sept., 1954. 112p. $2.25.

General topics related to the application of nuclear power for industrial purposes in Australia are presented. The discussion includes a general treatment of nuclear principles, and special emphasis is given to the importance of chemical engineering and chemical research in developing economical power sources. An account of the Rum Jungle uranium discovery and exploration is of particular interest. (K.S.)

BIOLOGY AND MEDICINE

2103 NP-5504

Statistical Research Lab., Univ. of Ill.

MULTIPLE SAMPLING TO ESTIMATE A PROPORTION. W. C. Healy, Jr. Dec. 15, 1954. 23p. Contract DA-11-22-ORD-881.

Methods are described for the application of multiple sampling to estimates of the proportion of members of a finite or infinite population having a particular attribute. (C.H.)

2104

THE RETENTION OF COBALT-60 IN VITAMIN B_{12}. A. G. Maddock and F. Pinto Coelho (Univ. Chemical Labs., Cambridge, England). J. Chem. Soc. (London), 4702-4(1954) Dec.

The retention of Co^{60} in vitamin B_{12} does not appear to be changed by heat treatment of the irradiated material. It was observed that the retention can not be due to failure of the recoil to rupture the molecule because the retention increases with the dose of pile radiation rising from 0.7 to 1.9% for an increase of about 40 times in the dose received. (auth)

2105

BIOSYNTHESIS OF CHLOROPHYLL, ATROPINE, GLUCOSE, AND ALBUMIN CONTAINING LABELED CARBON. V. I. Merenova (Institute of Biophysics, Moscow). Biokhimiya 19, 698-701(1954) Nov.-Dec. (In Russian)

Growth of Atrope belladonna in a $C^{24}O_2$ atmosphere is described, and specific activities of the labeled compounds obtained are listed. (G.Y.)

RADIATION EFFECTS

2106 AECU-2985

Pittsburgh Univ.

EFFECTS OF X-RADIATION ON INFLUENZA VIRUS. Anne Buzzell, Frank B. Brandon, and Max A. Lauffer. [Jan. 27, 1955]. 23p. Contract AT(30-1)-913.

Data are presented from studies of the effects x radiation on inactivation of infectivity and hemagglutination properties of influenza virus. Correlation between results and the target theory of radiation injury are discussed. (C.H.)

2107 AECU-2986

Pennsylvania Univ. School of Medicine

CYTOLOGICAL ANALYSIS OF ULTRAVIOLET IRRADIATED ESCHERICHIA COLI. I. CYTOLOGY OF E. COLI K12 AND A NON-LYSOGENIC DERIVATIVE. Philip E. Hartman, John I. Payne, and Stuart Mudd. [1955] 22p. Contract AT(30-1)-1342.

2108 AECU-2987

Pennsylvania Univ. School of Medicine

CYTOLOGICAL ANALYSIS OF ULTRAVIOLET IRRADIATED ESCHERICHIA COLI. II. ULTRAVIOLET INDUCTION OF E. COLI STRAIN K12. John I. Payne, Philip E. Hartman, Stuart Mudd, and Charlotte Liu. [1955]. 13p. Contract AT(30-1)-1342.

2109 NP-5511

School of Aviation Medicine

SOME EFFECTS OF CUMULATIVE DOSES OF X-RADIATION UPON LEARNING AND RETENTION IN THE RHESUS MONKEY. (Project No. 21-3501-0003, Report No. 11). Charles M. Rogers, Sylvan J. Kaplan, George Gentry and John A. Auxier. School of Aviation Medicine and Radiobiological Lab., Univ. of Texas. Nov. 1954. 15p.

Twelve rhesus monkeys were tested for ability to retain memory for a multiple discrimination task and eleven color discrimination tasks. They were tested also for ability to learn new color discrimination tasks after radiation. Six of the subjects were exposed to approximately 100 r of x radiation once a week during the experiment. Results indicate that up to the point where they no longer responded to stimuli the subjects showed no effects of cumulative exposrues to x radiation. (auth)

2110 NP-5516

School of Aviation Medicine

BIOLOGICAL AND MEDICAL ASPECTS OF IONIZING RADIATION. TOLERANCE TO SIMULATED ALTITUDE AFTER WHOLE-BODY X-IRRADIATION IN GUINEA PIGS. (Project No. 21-3501-0005, Report No. 17). Eugene B. Konecci. Oct. 1954. 6p.

The hypoxia tolerance curve as measured by the onset of unconsciousness was obtained by using 190 normal, male guinea pigs averaging 300 grams in weight. Pilot experiments were performed with 100 guinea pigs, and 70 guinea pigs were used in an experiment which was evaluated statistically. Whole-body exposures with a dose rate of 145 r per minute of 260 kvp x-radiation were used. In the statistically evaluated experiments, 20 animals received 500 r, 20 animals 1,600 r, and 10 animals 4,000 r, while 20 nonirradiated guinea pigs served as controls. Results indicate no difference in the 500 r group tested 1 hour after radiation, but a marked decrease in tolerance to hypoxia in the second 500 r group tested 24 hours after radiation.

The 1,600 r group tested 1 hour after radiation, the second 1,600 r group tested 24 hours after radiation, and the two 4,000 r groups tested at 1 hour and 24 hours post-irradiation, respectively, all displayed a statistically significant decrease to altitude tolerance with a P value of less than 0.01. (auth)

2111 USNRDL-TR-19

Naval Radiological Defense Lab.

PERFORMANCE DURING EXPOSURE TO IONIZING RADIATION. PART I. FOOD AND WATER CONSUMPTION OF RATS DURING EXPOSURE TO GAMMA RADIATION. PART II. A CONDITIONED AVERSION TOWARDS SACCHARIN RESULTING FROM EXPOSURE TO GAMMA RADIATION. J. Garcia, D. J. Kimeldorf, E. L. Hunt, and B. P. Davies. Nov. 12, 1954. 28p.

Rats consumed less water and food, and their body weight decreased during exposure to low intensity gamma radiation. Water consumption became less and less upon repeated exposure, while it was comparable to controls between exposures. Food consumption was similarly affected, but to a lesser degree. The normally high preference for saccharin-flavored water was nullified when this substance had been previously associated with radiation exposure. Radiation can act as an unconditioned stimulus for altering animal behavior. (auth)

2112

CELL DIVISION IN THE GIANT AMOEBA, PELOMYXA CAROLINENSIS, FOLLOWING X-IRRADIATION. II. ANALYSIS OF THERAPEUTIC EFFECTS AFTER FUSION WITH NONIRRADIATED CELL PORTIONS. Edward W. Daniels (U. S. Air Force Radiation Lab. and Univ. of Chicago, Ill.). J. Exptl. Zool. 127, 427-61(1954) Dec.

2113

THE EFFECTS OF HYPOPHYSECTOMY AND OF THYROXINE ON THE RADIATION-INDUCED CHANGES IN THE RAT THYROID. F. Maloof (Harvard Medical School and the Medical Service of the Massachusetts General Hospital, Boston). Endocrinology 56, 209-14(1955) Feb.

The thyroids of rats which had previously been given I^{131} show cellular hypertrophy and morphologic alterations in the nuclei. The cellular hypertrophy is completely and the nuclear changes are partially inhibited by hypophysectomy or the administration of DL-thyroxine. These latent histologic abnormalities become manifest two months after the cessation of DL-thyroxine. Some of the morphologic changes in the thyroid of the rat after sublethal thyroidal doses of I^{131} appear to be secondary and not primary effects of radiation. (auth)

2114

DELAYED TOXICITY OF RADIOSTRONTIUM IN MONKEYS G. M. Edington, J. M. Judd, and A. H. Ward (Univ. Coll. of the Gold Coast, Achimota). Nature 175, 33(1955) Jan. 1.

Six monkeys died following single injections of Sr^{90} of less than 0.2 mc/kg body-weight. Data are presented on hematological findings and survival-times and are compared with those in animals which received higher doses. (C.H.)

2115

RELATION OF THE INDIGENOUS FLORA OF THE SMALL INTESTINE OF THE RAT TO POST-IRRADIATION BACTEREMIA. James G. Vincent, Robert C. Veomett, and Richard F. Riley (Univ. of California, Los Angeles). J. Bacteriol. 69, 38-44(1955) Jan.

The predominant microorganism in the small intestine of the rat is a lactobacillus. It is accompanied by smaller populations of pseudomonas, proteus, and coliform organisms. Following 650 r of x irradiation the numbers of lactobacilli in the small intestine fall to one-fourth their normal numbers. The pseudomonads increase about 1,000-fold by the 7th day. The proteus organisms and coliforms show less marked increases. The invasion of the small intestine by gram negative organisms is paralleled by a bacteremia of types characteristic of the gram negative invaders in the gut. The severity of the invasion of the gut and tissues appears to correlate with the severity of the post-irradiation syndrome. A natural antagonistic relationship between the indigenous lactobacilli and the gram negative strains normally present in only low numbers in the small intestine is supported by the finding of antimicrobial activity against these organisms in cultures of the lactobacilli. (auth)

2116

INFLUENCE OF GAMMA RADIATION ON PROTEOLYTIC ENZYME ACTIVITY OF BEEF MUSCLE. D. M. Doty and James P. Wachter (Univ. of Chicago, Ill.). Agr. and Food Chem. 3, 61-3(1955) Jan.

Approximately 70% of the proteinase activity in beef muscle tissue could be extracted with citrate buffer at pH 9.6. Irradiation with Co^{60} at dosages of 1.6×10^6 rep. reduced the apparent proteinase activity of beef muscle about 50%. This loss occurred largely in the fraction of the enzyme that was extractable at pH 9.6. At lower irradiation dosages there was little reduction in proteinase activity as measured by liberation of tyrosine from casein substrate. Irradiation reduced the amount of tyrosine extractable from beef, which suggests that the amino acid is changed by irradiation. (auth)

2117

NATURE OF UNDESIRABLE ODORS FORMED BY GAMMA IRRADIATION OF BEEF. O. F. Batzer and D. M. Doty (Univ. of Chicago, Ill.). Agr. and Food Chem. 3, 64-7(1955) Jan.

Precipitates were obtained by trapping the effluent gases from irradiated meat in solutions of lead acetate, zinc acetate, and mercuric cyanide. Analyses of these precipitates indicated sulfur compounds as the source of some undersirable odors in irradiated meat. Glutathione determinations indicated a considerable reduction of this and/or other sulfhydryl compounds during irradiation. Fractionation of beef to locate the source of some of the off-odors suggested that they are formed from some water-soluble compounds. (auth)

2118

BETA RADIATION CATARACTS. James E. McDonald, William F. Hughes, Jr., and Vincent G. Peiffer (Univ. of Illinois Coll. of Medicine, Oak Park). Arch. Ophthalonol. (Chicago) 53, 248-59(1955) Feb.

Studies on rabbit and human eyes exposed to beta radiation from radon and $Sr^{90}-Y^{90}$ have shown the localized cataractogenic effect of these emanations in sufficient dosage. The threshold is lower when such ratiation is applied over the limbus, resulting in equatorial opacities and vacuoles which migrate posteriorly. Tentative cataractogenic dosage schedules are presented. This complication should therefore be considered in the clinical use of beta radiation on the globe. (auth)

2119

AN EXPERIMENTAL STUDY OF RADIATION-INDUCED ANAEMIA WITH REFERENCE TO SHIELDING PROCEDURES AND PLATELET CHANGES. L. F. Lamerton and C. F. Baxter (Royal Cancer Hospital, London, England). Brit. J. Radiol. 28, 87-94(1955) Feb.

Experimental data are presented concerning the effect of various shielding procedures on the response of the young growing rat to large volume irradiation. It is shown that the shielding of certain tissues containing active bone marrow will very much reduce the severity of the radiation-induced anaemia and of the second weight loss without apparently affecting the weight loss suffered by the animal immediately following irradiation. Shielding of a portion of skin does not appear to affect the response of the animal. Platelet investigations on the irradiated rat are described with some experimental data on the effect of shielding on the platelet fall. Experimental work on platelet changes following the administration of radioactive phosphorus is described and discussed in relation to the degree of anemia produced. (auth)

2120

EFFECT OF X-IRRADIATION ON PURINE-METABOLIZING ENZYMES OF RAT LIVER AND SPLEEN. Herbert J. Eichel (Hahnemann Medical Coll., Philadelphia, Penna.). Proc. Soc. Exptl. Biol. Med. 88, 155-8(1955) Jan.

Whole-body x irradiation had no effect on the activities of rat liver adenosine deaminase and nucleoide phosphorylase studied at intervals over a 10-day period following exposure. The specific activity of spleen nucleoside phosphorylase increased, although the total organ enzyme activity was reduced as a result of the decrease in spleen size. (auth)

RADIATION HAZARDS AND PROTECTION

2121

THE PROTECTIVE EFFECT OF CYSTEAMINE ON YOUNG MICE EXPOSED TO ROENTGEN RAYS. Arne Nelson (Research Inst. of National Defence, Sundbyberg, Sweden). Acta Radiol. 42, 485-93(1954) Dec.

The protective effect of cysteamine against ionizing radiation has been investigated in young mice. Observations upon the weight and time and rate of survival suggested that cysteamine afforded a good protective effect if given about 30 minutes before a dose of irradiation of up to 800 r and was also of some value when this amounted to 1,000 r. (auth)

2122

EDUCATION IN RADIATION PROTECTION. JANEWAY LECTURE, 1954. Lauriston S. Taylor (National Bureau of Standards, Washington, D. C.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 73, 193-202(1955) Feb.

The responsibility of the radiologist not only to learn the science of radiation protection but to put the problem of radiation protection into proper perspective with relation to society is stressed. The significence of the education of the public in radiation protection and the potential dangers of radiation are discussed. Educational and training requirements designed to assure the young radiologist maximum advantages of our present knowledge of radiation are reviewed. Methods of instruction in radiation protection, radiation monitoring procedures, and the role of radiation legislation in radiation protection are discussed. (C.H.)

RADIATION SICKNESS

2123

COUNTERACTING THE ACUTE RADIATION SYNDROME WITH CORTICOTROPIN (ACTH). Kenneth W. Taber (Memorial General Hospital, Elkins, West Va.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 73, 259-64 (1955) Feb.

The treatment of postirradiation injury with corticotropin in small doses is of value. Corticotropin in small doses should be included in the armamentarium of drugs used whenever radiation hazard exists, whether in the treatment of malignant conditions by roentgen radiation, in the use of radioactive isotopes or in fission bomb disasters. It has made it possible for us to administer radiation therapy more intensively and in much higher doses through a grid without unwarranted discomfort to the patient. (auth)

RADIOTHERAPY

2124

IRRADIATION OF SKIN TUMOURS DURING PURE OXYGEN INHALATION. K. A. Hultborn and A. Forssberg. Acta Radiol. 42, 475-84(1954) Dec.

Following a brief survey of the theoretical considerations, four cases of skin tumors treated by trial irradiation with the concomitant inhalation of pure oxygen are presented. The results, which are encouraging, are discussed. It is emphasized that the communication is in the nature of a preliminary report. (auth)

2125

A COBALT 60 BEAM UNIT WITH A SOURCE-SKIN DISTANCE OF 20 CM. F. W. Spiers and Margaret T. Morrison (Univ. of Leeds and General Infirmary, Leeds, England). Brit. J. Radiol. 28, 2-7(1955) Jan.

A description is given of the conversion of a radium beam unit to a Co^{60} unit operating at 20 cm with a source strength of about 100 c. With this loading the apparatus has an output of about 50 r/min and provides well-defined γ-ray beams with depth doses approximately equivalent to those obtained with x rays of H.V.L. 3 mm Cu at an F.S.D. of 50 cm. Data are given of the stray radiation around the unit, and conditions are laid down for the safe and reliable functioning of the pneumatic transference mechanism. (auth)

2126

A 50 CURIE COBALT 60 TELETHERAPY UNIT. W. H. Fry, H. Miller, and K. F. Orton (Sheffield National Centre for Radiotherapy, England). Brit. J. Radio. 28, 8-12(1955) Jan.

The conversion of a 5 g radium beam unit to one containing 50 c of Co^{60} is described. The conversion necessitated a number of modifications to the existing unit and additional protective devices. The distributions of the radiation in a phantom is described and also the build-up of ionization in the first few millimeters below the surface. Dose distributions for typical treatments are shown, and the volume dose obtained using such a unit is discussed. (auth)

2127

A NEW METHOD OF TREATMENT OF INOPERABLE BRAIN TUMOURS BY STEREOTAXIC IMPLANTATION OF RADIOACTIVE GOLD. A PRELIMINARY REPORT. J. Talairach, G. Ruggiero, J. Aboulker and M. David (Centre Neurochirurgical de l 'Hospital Ste Anne, Paris', Brit. J. Radiol. 28, 62-74(1955) Feb.

A new method of treatment of inoperable brain tumours has been tried out in five cases. This is based on a combination of fractional encephalography and the stereotaxic technique described by Talairach. In four of these cases the patients' general condition was extremely serious, and death was imminent. Very encouraging results have been obtained in three cases. (auth)

2128

INSTRUMENTAL AND TECHNICAL NOTES. AN ISOTOPE SURVEY COUCH. B. R. Worsnop (Middlesex Hospital Medical School, London, England). Brit. J. Radiol. 28, 116(1955) Feb.

A directional scintillation radiation detection instrument was attached in a perpendicular position to a simple couch and an apparatus designed to move the counter accurately in three dimension over the patient. Good results were obtained in determinations of the position of γ-emitting isotopes within the human body. (C.H.)

2129

STRAY RADIATION MEASUREMENTS AROUND A COBALT 60 BEAM THERAPY INSTALLATION. Lillian E. Jacobson and Isabelle S. Knauer (Montefiore Hospital, New York). Am. J. Roentgenol. Radium Therapy Nuclear Med. 73, 272-80(1955) Feb.

The design of the protection for a room to house a cobalt 60 beam therapy unit with an output of 32 r per minute at 80 cm source skin distance is illustrated. Isostray curves are drawn for all occupied areas, with the direct beam striking the scattering medium vertically or horizontally. Isostray curves are drawn for the scattered radiation inside the room, with the beam in the horizontal and in the vertical directions. These curves can serve as a guide in calculating the thickness of wall needed for protection at various distances from the cobalt unit. The attenuation factor through the special lead oxide glass window, was measured for the beam scattered when the radiation was directed vertically against the phantom and horizontally, the scattering angle being different in each case. It was found to be 3,800 for the scatter from the horizontal beam and 500 for the scatter from the vertical beam. The half-value layer of the former stray radiation measured 4 mm Cu. To find how much protection a barrier wall would give to the steel door, an experimental wall was built of movable cinder blocks. The attenuation factor was measured and found to be more than adequate. A barrier wall of concrete 8 inches thick was built. The attenuation of stray radiation was measured. It is recommended that where possible a maze of concrete be built leading to the entrance to the room. This obviates heavy and expensive doors. (auth)

CHEMISTRY

2130 AD-29189

Northwestern Univ.

HEIGHT AND GEOGRAPHICAL DISTRIBUTION OF THE OXYGEN ISOTOPES. FINAL REPORT. Malcolm Dole, D. P. Rudd, D. A. Zaukelies, J. B. Brown, and G. A. Lane. Jan. 1, 1954. 144p. Contracts AF19(122)-157 and AF19 (604)-587.

Measurements were made of the relative abundance of O isotopes in the atmosphere by the water density method and by the use of a sensitive mass spectrometer. The amounts of N isotopes were measured by the mass spectrometer. The sensitivity of the water density method was about ±0.2 ppm in the density of the water, and the sensitivity of the mass spectrometer was ±0.025% in the percentage of O^{18}. Samples were tested of ground-level air from the United States, South and Central America, Finland, Holland, Japan, Australia, and the Arctic. None of these samples exhibited variations in the O^{18} percentage except air taken directly over actively photosynthesizing kelp beds in the Pacific Ocean. Air samples which had been dissolved in Pacific Ocean water at great depth showed an increase in O^{18} percentage as the percentage of O in the sample decreased. The fractionation factor for this process was estimated to be 0.991. The isotopic composition of N isotopes was normal with depth. The O and N isotopic abundances of air collected during balloon flights up to 87,000-ft altitudes were considered normal. Deviations in isotopic abundances in air collected by Aerobee rockets up to 51.6 km were not considered significant. Laboratory tests of the isotopic fractionation of O isotopes during the clean-up of O at room temperature by initially clean copper and steel surfaces were considered to prove that isotopic fractionation can occur and that the fractionation has the same magnitude and direction as the fractionation observed in the air collected by rockets. (ASTIA abs)

2131 CCC-1024-TR-85

Pennsylvania Coll. for Women

THE PREPARATION AND PROPERTIES OF TETRA-ALKYL-AMMONIUM BOROHYDRIDES. E. K. Wallace, J. Bridges, J. Dering, J. Dumot, N. Eisley, S. Hartmen, R. McCombs, and M. Santisteban. Jan. 12, 1955. 9p. For [Callery Chemical Co. Contract Noa(s) 52-1024-c].

Four tetraalkylammonium borohydrides were prepared in small quantities, namely, tetra-n-propyl-, tetra-n-butyl-, tetra-n-pentyl-, and tetra-n-heptylammonium borohydrides. The method used in most part was to heat stoichiometric amounts of tri-n-alkyl amines and the corresponding alkyl bromides in a sealed tube to form the tetra-n-alkylammonium bromides; the bromides then were converted to fluorides by treatment with mercurous fluoride. As an alternate procedure, alkyl bromide was converted to the corresponding fluoride by dropping the n-alkyl bromide into a solution of potassium fluoride in ethylene glycol and distilling the reaction product. The n-alkyl fluoride was converted into tetra-n-alkylammonium fluoride by heating the alkyl fluoride with the corresponding tri-n-alkyl amine. The tetra-n-alkylammonium fluoride was then converted into tetra-n-alkylammonium borohydride by treating it with sodium borohydride. Solubilities and melting points of the final products as well as of intermediate products have been summarized. (auth)

2132 CCC-1024-TR-86

Wisconsin Univ.

VAPORIZATION STUDIES OF BORIC OXIDE. J. L. Margrave and J. R. Soulen. Jan. 14, 1955. 9p. For [Callery Chemical Co. Contract NOa(s) 52-1024-c].

The necessity for auxiliary experiments in the study of vaporization of substances at high temperatures is discussed. Earlier work pertaining to the vaporization of B_2O_3 is reviewed, and new vapor pressure determinations are presented which extend the temperature range of the measurements. In the temperature range studied, B_2O_3 was found to vaporize as the $B_2O_3(g)$ molecule, and a vapor pressure equation is given. ΔH_s° of sublimation has also been calculated from vapor pressure data for B_2O_3 with the aid of free energy functions. Vapor pressure measurements have been supplemented by spectroscopic observations; bands attributable to the $B_2O(g)$ molecule have been found. (auth)

2133 ISC-517
Ames Lab.
SUBSTITUENT EFFECTS ON THE SPECTRA AND IONIZATION CONSTANTS OF DIAROYLMETHANES. Wilfred George Borduin and George S. Hammond. Mar. 1954. 24p. Contract W-7405-eng-82.

A series of meta- and para-substituted dibenzoylmethanes were prepared for the systematic correlation of structure with the chelating properties of organic compounds. The diketones were studied by both infrared and ultraviolet spectra, and their acidity constants were measured in 75% dioxane–water. (auth)

2134 NP-5024
Technical Information Div., Library of Congress
REPORTS ON BORON COMPOUNDS. (ABSTRACT BULLETIN U5). Feb. 9, 1955. 13p.

2135 NYO-6617
Metals Research Lab., Carnegie Inst. of Tech.
ELECTROCHEMICAL STUDIES OF NON-AQUEOUS MELTS. QUARTERLY PROGRESS REPORT [FOR] PERIOD ENDING DECEMBER 20, 1954. R[obert] F. Mehl and G[erhard] Derge. 6p. Contract AT(30-1)-1024.

The electric conductivity of sulfides under a controlled H_2S-H_2 atmosphere and tests to establish the presence or absence of secondary reactions in the experimental system are briefly discussed. The average value of the self-diffusion coefficient of Fe in molten FeS at 1115°C using radioactive Fe was found to be $1.74 \pm 0.63 \times 10^{-5}$ cm²/sec, which was compared with that of other liquid systems. The electrolysis of $Al_2O_3-CaO-SiO_2$ slags containing about 1% S added as CaS or MnS failed to deposit the S at the anode. (For preceding period see NYO 6616.) (J.A.G.)

2136 UCRL-2841
Radiation Lab., Univ. of Calif., Berkeley
CHEMISTRY DIVISION QUARTERLY REPORT [FOR] SEPTEMBER, OCTOBER, NOVEMBER 1954. Jan. 10, 1955. 46p. Contract W-7405-eng-48.

Progress is reported in studies on measurement of rate and C^{14}-tracer studies of carboxylation reactions during photosynthesis; the dark fixation of CO_2 by Euglena; the utilization of 3-hydroxypyruvic acid by Scenedesmus; design modifications in an instrument for the continuous measurement of breath-$C^{14}O_2$ metabolism rates in humans; tracer studies of the acute effect of nicotine on the metabolism of CO_2 to acetate in normal rats; the performance of a liquid scintillation counter for tritium measurement; the decarboxylation of 1-(4-nitrophenyl)-5-phenyl-2,3-pyrrolidinedione; preparation of DL-thioctic acid and leucylalanine-2-C^{14}; radiation decomposition of choline chloride and its analogs; radiation chemistry of benzoic acid; radiation decomposition of thioctic and bisnor thioctic acid; Pu^{239} fission products after long intense neutron irradiation; Yb^{175} γ emission; $Ba^{128}-Cs^{128}$ decay scheme; coincidence studies on Cf isotopes; alpha decay of spheroidal nuclei; a modified point field-emission ion source for use in mass spectroscopy; modification of a double-retarding-field β spectrometer; preparation of InI_3 and structure of InI; and fluoride complexing of Cu^{++}, Zn^{++}, Ag^{+}, and Hg^{++}. (For preceding period see UCRL-2709.) (C.H.)

2137 UCRL-2854
Radiation Lab., Univ. of Calif., Berkeley
HEATS OF SUBLIMATION OF THE ELEMENTS. Leo Brewer. Feb. 1955. 8p. Contract W-7405-eng-48.

The heats of sublimation of the elements at 298°K to the various elemental gaseous species are tabulated. (auth)

2138 AEC-tr-2068
INVESTIGATION OF THE SYSTEM $Na_2O-SiO_2-ZrO_2$. J. D'Ans and J. Loeffler. Translated by Gabriele Wohlauer from Z. anorg. Chem. 191, 1-35(1930). 38p.

2139 AEC-tr-2069
PHYSICO-CHEMICAL PROPERTIES OF FUSED SALTS. I. ELECTRIC CONDUCTIVITY OF SIMPLE SALTS. II. ELECTRIC CONDUCTIVITY OF MIXED SALTS. (PART 1). Kaoru Sakai. Translated from J. Chem. Soc. Japan, Pure Chem. Sect. 75, 182-9(1954). 23p.

2140 AEC-tr-2074
PHYSICAL CHEMISTRY—CONCERNING AQUEOUS SOLUTIONS CONCENTRATED WITH NITRIC ACID. EFFECT OF THE ADDITION OF MINERAL NITRATES (VAPOR TENSION, CALORIMETRY). (Chimie Physique—Sur Les Solutions Aqueuses Concentrees D'acide Nitrique. Effet De L'addition De Nitrates Mineraux (Tension De Vapeur, Calorimetriz). Jean Chedin, René Leclerc, and Robert Vandoni. Translated by Elsie Qualls from Compt. rend. 225, 734(1947). 4p.

2141
THE CHEMICAL DETERMINATION OF THE ION CHARACTERISTICS OF LITHIUM BOROHYDRIDE. Gerhard Norbert Schrauzer (Institut für Anorganische Chemie der Universität München, Germany). Naturwissenschaften 42, No. 2, 43-4(1955) Jan. (In German)

2142
SINGLE ION FREE ENERGIES AND ENTROPIES OF AQUEOUS IONS. Wendell M. Latimer (Univ. of California, Berkeley). J. Chem. Phys. 23, 90-2(1955) Jan.

Single ion free energies of hydration were assigned by Latimer, Pitzer, and Slansky (J. Chem. Phys. 7, 108(1939)) by choosing a set of ion radii which made both negative and positive ions fall on the theoretical Born curve in a plot of ΔF against $1/r'$. The r' values were the crystal ion radii plus 0.1 A for negative ions and plus 0.85 A for positive ions. It is now shown that this assignment of single ion free energies is consistent with the single ion entropies of hydration if $\bar{S}_{H^+}$ is −2.1 (the Eastman value). The ΔS values are proportional to Z/r' and the tentative suggestion is made that it is the temperature coefficient of r' which leads to the Z/r' function. It is proposed that the ΔF values be used to calculate a consistent set of radii of aqueous ions which will take into account coordination numbers and polarization. (auth)

2143
C^{13} ISOTOPE EFFECT IN THE THERMODECOMPOSITION OF ETHYL BROMIDE. Henry L. Friedman, Richard B. Bernstein, and Harry E. Gunning (Illinois Inst. of Tech., Chicago). J. Chem. Phys. 23, 109-12(1955) Jan.

The $C^{12}-C^{13}$ fractionation factor in the decomposition of gaseous ethyl bromide has been measured from 350 to 450°C, using samples of natural isotope abundance. The rate constants are defined as follows: $CH_3CH_2Br \rightarrow CH_2 = CH_2 + HBr$, k_1; $CH_3C^*H_2Br \rightarrow CH_2 = C^*H_2 + HBr$, k_2; $C^*H_3CH_2Br \rightarrow C^*H_2 = CH_2 + HBr$, k_3. At 400°C, the C^{12} enrichment of the first fraction of ethylene from decomposition of the ethyl bromide is $S_0 \equiv 1 + \epsilon_0 = 2k_1/k_2 + k_3 = 1.0079 \pm 0.0006$, with a temperature coefficient of -2.8×10^{-5}/°C. The primary and secondary isotope effects are defined, respectively, as $\beta = k_1/k_2 - 1$ and $\gamma = k_1/k_3 - 1$;

thus, to a good approximation, $\beta + \gamma = 2\epsilon_0$. According to theory, $\beta > \gamma \geq 0$, so that $\epsilon_0 < \beta \leq 2\epsilon_0$ and $\epsilon_0 > \gamma \geq 0$. From the data of 400°C one then obtains as an upper limit $(k_1/k_2)_{max} \leq 1.0159 \pm 0.0012$. This is significantly lower than the value $k_1/k_2 \geq 1.036$ calculated for the rupture of an isolated C—Br bond. The present results, therefore, favor a mechanism involving the direct intramolecular elimination of HBr. (auth)

2144

LCAO MO STUDY OF THE PHENOMENON OF THERMOCHROMISM. Sheldon L. Matlow (Brookhaven National Lab., Upton, N. Y.). J. Chem Phys. 23, 152-4(1955) Jan.

An LCAO MO calculation of the energies of the ground, planer triplet, and perpendicular triplet states of bianthrone and bixanthylene indicates that the thermally excited state in the phenomenon of thermochromism is the perpendicular triplet. Because of the uncertainty of the correct values of the parameters used, the best correspondence between the calculated and observed excitation energies that could be expected is that of order of magnitude. This is shown to be the case. The nature of the variation of the calculated values with the choice of parameters is indicated. (auth)

2145

THE REACTION OF NITROGEN WITH, AND THE DIFFUSION OF NITROGEN IN, BETA ZIRCONIUM. M. W. Mallett, Jack Belle, and B. B. Cleland (Battelle Memorial Inst., Columbus, Ohio). J. Electrochem. Soc. 101, 1-5(1954) Jan.

The rate of reaction of nitrogen with high-purity zirconium was determined for the temperature range of 975 to 1640°C at 1 atm pressure. The reaction followed a parabolic law, and the parabolic rate constant in $(ml/cm^2)^2/sec$ was calculated to be $k = 5.0 \times 10^3 \exp(-48{,}000/RT)$, where 48,000 ± 1500 cal/mole is the activation energy for the reaction. The rate of diffusion of nitrogen in beta zirconium was obtained for the temperature range of 920 to 1640°C at 1 atm pressure. Diffusion-rate calculations based on a solution of the usual diffusion equation gave a diffusion coefficient, $D = 1.5 \times 10^{-2} \exp(-30{,}700/RT)$ cm^2/sec. The energy of activation of diffusion, 30,700 cal/mole, has a probable error of 1000 cal/mole. The calculated entropy of activation for diffusion is 3.5 cal/mole degree. The limiting solubilities of nitrogen in beta zirconium were determined from the diffusion data. The heat of solution of nitrogen in beta zirconium is 12,900 ± 500 cal/mole. (auth)

2146

THE RATE OF DISSOLUTION AND THE PASSIVATION OF TITANIUM IN ACIDS WITH AMMONIUM FLUORIDE ADDED. M. E. Straumanis and C. B. Gill (Univ. of Missouri, Rolla). J. Electrochem. Soc. 101, 10-15(1954) Jan.

Although Ti is very resistant to the action of all acids, except HCl, H_2SO_4, and especially HF, its resistance breaks down if soluble fluorides are added to the acidic solutions. It was found that the HF liberated by acids partially dissolves the protective film that is always present on the surface of Ti. Hydrogen ions then are discharged at the local cathodes, which are now exposed to the acids through the pores of the film. In agreement with this concept, the rate of dissolution of Ti increases only slightly with increased concentration of a strong acid (HCl, H_2SO_4), at a constant concentration of NH_4F, but it increases greatly with increased concentration of NH_4F (at a constant concentration of the strong acid). If the concentration of NH_4F is increased still further, the Ti becomes passive, and simultaneously its potential decreases to −0.94 volt (hydrogen scale). This passivation could be explained by formation of a partial salt film on the surface of the dissolving Ti, and by increase of hydrogen overvoltage on local cathodes, because of the NH_4F present. (auth)

2147

THE ELECTROLYTIC PREPARATION OF MOLYBDENUM FROM FUSED SALTS. III. STUDIES OF ELECTRODE POTENTIALS. Seymour Senderoff and Abner Brenner (National Bureau of Standards, Washington, D. C.). J. Electrochem. Soc. 101, 31-8(1954) Jan.

Polarization and equilibrium potential studies in molten halide solutions are described. A new reference half-cell, i.e., Ag, AgCl, was used. It was found that molybdenum is rather noble (between copper and silver) in the emf series in this system, but that oxides are preferentially deposited if oxycompounds are present. Evidence for ionic association and complex formation in molten halides at 600°C is discussed. (auth)

2148

NIOBIUM CARBIDES. G. Brauer, H. Renner, and J. Wernet. Z. anorg. u. allgem. Chem. 277, 249-57(1954) Dec. (In German)

From niobium dioxide, niobium carbide was prepared with the composition between $NbC_{1.00}$ and Nb and the existing phase relation investigated. There exists three phases in the system Nb—C: the monocarbide phase of $NbC_{1.00}$ to $NbC_{0.72}$ homogeneous with rock salt lattice, the subcarbide phase of $NbC_{0.50}$ to $NbC_{0.72}$ homogeneous with hexagonal dense spherical packing of the Nb atom, and the Nb metal phase with a dissolving power for C with the structure $NbC_{0.02}$. (tr-auth)

2149

ION ACTIVITY MEASUREMENTS WITH RESIN MEMBRANE ELECTRODES. PART II. DETERMINATION WITH BIVALENT IONS AND BEHAVIOUR OF MEMBRANE ELECTRODES WITH CATIONIC MIXTURES. S. K. Sinha (Presidency Coll., Calcutta, India). J. Indian Chem. Soc. 31, 572-6(1954) Aug.

Resin membrane electrodes have been used to measure the the activities of bivalent cations, viz., Ca and Mg, in electrolytic solutions. The range of concentrations to which measurement is possible is less in the case of bivalent ions than in monovalent ions. A new resin, viz., RF-resin, has been found suitable for the measurement of Na-ion activity in presence of Ca ions. Possibility of determination of Na-ion activity in presence of K ions and vice versa with the help of "mobility ratio" has also been indicated, using resin membrane electrodes. (auth)

2150

ION ACTIVITY MEASUREMENTS WITH RESIN MEMBRANE ELECTRODES. PART III. DETERMINATION OF ANION ACTIVITY. S. K. Sinha (Presidency Coll., Calcutta, India). J. Indian Chem. Soc. 31, 577-80(1954) Aug.

Membrane electrodes prepared from different anion-exchanging resins have been used for the measurement of the activity of chloride and sulphate ions. The effect of cations on the activities of the chloride ions have also been studied. Attempts to measure the activities of polyvalent ions with suitable membranes have yielded some interesting results. (auth)

2151

THE HYDRATION OF DESOXYRIBONUCLEIC ACID. Jui H. Wang (Yale Univ., New Haven, Conn.). J. Am. Chem. Soc. 77, 258–60(1955) Jan. 20.

The self-diffusion coefficient of water in aqueous sodium desoxyribonucleate solution at 25° was determined as a function of concentration. The hydration of sodium desoxyribonucleate computed from the measured results is about 0.35 g of water per g of the dry desoxyribonucleate. The effect of added salt on the hydration and shape of the nucleic acid molecule is examined, and the broadening of the proton magnetic resonance lines in aqueous sodium desoxyribonucleate solutions is discussed. (auth)

2152

HIGH TEMPERATURE HEAT CONTENT AND ENTROPY OF LITHIUM OXIDE AND LITHIUM HYDROXIDE. C. Howard Shomate and Alvin J. Cohen (U. S. Naval Ordnance Test Station, China Lake, Calif.). J. Am. Chem. Soc. 77, 285–6(1955) Jan. 20.

The high temperature heat contents of lithium oxide and lithium hydroxide were measured in a "drop" calorimeter. Both materials were enclosed in sealed gold capsules. Measurements on lithium oxide were carried to 1050°K, and lithium hydroxide to 900°K. The heat of fusion of lithium hydroxide was determined to be 5010 cal/mole at 744.3°K. (auth)

2153

THE VAPORIZATION OF TiN AND ZrN. Michael Hock, David P. Dingledy, and Herrick L. Johnston (Ohio State Univ., Columbus). J. Am. Chem. Soc. 77, 304–6(1955) Jan. 20.

The vaporization of TiN and ZrN has been studied by the Knudsen effusion method between 1987 and 2241 and 2236 and 2466° K, respectively. Whereas TiN vaporizes to gaseous Ti and N_2, the heat of reaction being $\Delta H^0_0 = 191.20$ kcal, ZrN decomposes to solid Zr and N_2 with $\Delta H^0_0 = 79.53$ kcal/mole. From these data, the standard heat of formation for TiN is $\Delta H^0_{298} = 79.4$ kcal/mole; and for ZrN, $\Delta H^0_{298} = 80.43$ kcal/mole. (auth)

2154

MISCIBILITY OF LIQUID METALS WITH SALTS. I. THE SODIUM–SODIUM HALIDE SYSTEMS. M. A. Bredig, J. W. Johnson, and Wm. T. Smith, Jr. (Univ. of Tennessee, Oak Ridge and Knoxville). J. Am. Chem. Soc. 77, 307–12(1955) Jan. 20.

Techniques have been developed for the determination of the equilibria existing between liquid sodium metal and the four sodium halides up to approximately 1050°. All these systems are similar in that a monotectic exists a few degrees below the melting point of the pure salt. Mutual solubility of salt and metal in their liquid phases was actually measured up to approximately 25 mole per cent. Since it increases rather rapidly with temperature it was possible to estimate the temperatures of miscibility in all proportions by extrapolation. For all four systems these were found to be in the neighborhood of 1000 to 1100°. The difference between the monotectic and the consolute temperatures, or the area of immiscibility in the liquid state, thus increases as the salt component changes from fluoride to iodide. Heats of solution of the solid salts in the liquid metal were calculated from the temperature coefficients of solubility. The nature of the liquid metal–salt solutions is discussed briefly and tentatively in terms of the packing of ions and of mutual substitution of electrons and anions. (auth)

2155

MAGNETIC STUDIES OF NICKEL(II) AND PALLADIUM(II) COMPLEXES WITH SOME VIC-DIOXIMES. Charles V. Banks, Roy W. Vander Haar, and Raymond P. Vander Wal (Iowa State Coll., Ames). J. Am. Chem. Soc. 77, 324–5 (1955) Jan. 20.

2156

NOTE ON THE VOLATILITY OF LITHIUM OXIDE. A. E. van Arkel, U. Spitsbergen, and R. D. Heyding (Univ. of Leiden, Netherlands). Can. J. Chem. 33, 446–7(1955) Feb.

Powdered Li_2O was heated in vacuo and in dry O at 1000°C for extended periods of time. No appreciable decrease in weight could be detected after a small initial decrease attributed to the decomposition of impurities. The oxide disappeared rapidly when heated in the presence of O containing small amounts of water vapor. The percentage loss in weight was found to increase with increasing water vapor pressure. Some of the volatile material was condensed and found to be anhydrous LiOH. If this were the primary product of the reaction, the volatility of Li_2O could be ascribed to the reaction $Li_2O_{(s)} + H_2O_{(g)} \rightarrow 2LiOH_{(g)}$. (M.P.G.)

2157

THE STABILITY CONSTANTS OF THE INDIUM HALIDES. B. G. F. Carleson and H. Irving (Inorganic Chemistry Lab., South Parks Road, Oxford, England). J. Chem. Soc. (London), 4390–9(1954) Dec.

Stepwise equilibrium in complex solutions of indium halides at 20° has been investigated for halide concentrations up to 0.5M. Radioactive indium was employed in conjunction with a strong cation-exchange resin in the H^+-form, and the ionic strength was maintained at 0.691M with perchloric acid. The existence of the complex species InA^{2+}, InA_2^+, and InA_3 was established (A = Cl^-, Br^-, and I^-) and their stability constants, K_j, were measured. The stabilities decreased in the order Cl > Br > I, and $K_1 > K_2 > K_3$. Anionic complexes were shown to be considerably weaker. (auth)

2158

THE HEAT OF FORMATION OF AURIC AND THALLIC FLUORIDES. A. A. Woolf (Manchester Univ., England). J. Chem. Soc. (London), 4694–5(1954) Dec.

2159

THE INTERACTION OF OXYGEN WITH CLEAN METAL SURFACES. M. A. H. Lanyon and B. M. W. Trapnell (Univ. of Oxford, England). Proc. Roy. Soc. (London) A227, 387–99 (1955) Jan. 20.

Isobars for the adsorption of O_2, H_2, and CO on evaporated films of Rh, Mo, W, and Fe, of O_2 and CO on Ta, Pt, and Pd, and of O_2 on Cu, Al, and Zn have been obtained. On Rh, Mo, and W the rapid adsorption of O_2 and H_2 at −183°C results in formation of monolayers with one atom per surface atom. On Ta, Pt, Pd, Cu, Al, and Zn oxygen, and on Fe hydrogen, form similar monolayers, but on Fe oxygen forms several layers of oxide. On Rh, Mo, and possibly Ta the fast CO chemisorption corresponds to a two-site mechanism; on W and Fe it lies between that for a single and a two-site mechanism; on Pt and Pd single-site adsorption may take place. Kinetics of slow oxygen uptake have been followed on Rh, Mo, W, Ta, Fe, Cu, and Zn. With Rh, Mo, W, Ta, and Zn it is believed that formation of the first oxide layer has been observed, and the rate expression is given. The suggested mechanism is interchange of adsorbed oxygen atoms with underlying metal atoms, whereby metal atoms are exposed for further oxygen adsorption. On Cu and Fe formation of up

to six and ten oxide layers respectively have been observed, and the rate expressions have been interpreted in terms of the theory of Cabrera & Mott (1948). (auth)

ANALYTICAL PROCEDURES

2160 AD-43150

Kansas Univ.

COULOMETRIC METHODS OF ANALYSIS. FINAL REPORT. [AUTOMATIC COULOMETRIC TITRATION WITH PHOTOMETRIC DETECTION OF EQUIVALENCE]. [1953?]. 89p. Contract DA-23-072-ORD-217.

Design and performance of an all-electronic self-contained coulometric titration instrument which operates from the 115-v alternating current line to produce a constant current for coulometric titrations over a continuously variable range of from 15 to 200 ma are described. The instrument incorporates provision for automatic termination of the titration by photometric detection of the endpoint. Two types of photometric detection were employed and are described. (C.H.)

2161 CCC-1024-TR-81

Northwestern Univ.

THE DETERMINATION OF BORON IN ORGANIC BORON COMPOUNDS BY ELECTROLYTIC METHODS. D[onald] D. Deford and J. M. Thoburn. Dec. 28, 1954. 24p. For [Callery Chemical Co. Contract NOa(s) 52-1024-c].

An electrolytic method of general utility has been devised for the determination of boron in organic boron compounds. The method has been tested on fourteen different compounds, some of which were of doubtful purity, with an average error of ± 1.3% and an average precision of ± 0.6%. The average error on compounds which were believed to be of high purity was less than ± 0.5%. The sample is weighed into a small reaction flask containing a pair of platinum electrodes. Five ml of concentrated nitric acid is added to the sample; in the case of the more reactive compounds the acid must be added very slowly. The solution is electrolyzed for a period of four hours with a direct current of two to four amperes. After the reaction is complete the solution is transferred from the reaction flask to the titration vessel. Sulfamic acid is added to destroy nitrous acid, and the boric acid is titrated with base in the presence of mannitol in the customary manner. A pH meter is needed to determine the end points. The boron is quantitatively converted to boric acid and essentially no carbon dioxide is formed during the decomposition. The method is subject to interference from some organic acids if present in large concentrations. (auth)

2162 KAPL-1275

Knolls Atomic Power Lab.

THE RAPID PRECISION DETERMINATION OF COBALT IN ALLOY STEELS BY THE POTRATZ TETRAPHENYLARSONIUM METHOD. L[eonard] P[aul] Pepkowitz and J. L. Marley. Feb. 11, 1955. 12p. Contract W-31-109-Eng-52.

The tetraphenylarsonium method described by Potratz is highly recommended for the determination of cobalt in stainless steels and other ferrous samples. The method is rapid and quite precise, being equally as good as the usual reference procedure. Exceptionally good precision is obtained, and the procedure is applicable to a wide variety of materials. (auth)

2163 NAA-SR-1103

North American Aviation, Inc.

DETERMINATION OF MICRO-AMOUNTS OF BORON IN URANIUM METAL AND IN URANIUM SOLUTIONS BY THE CURCUMIN-ACETONE SOLUTION METHOD—WITHOUT SEPARATION FROM URANIUM. Louis Silverman and Katherine Trego. Feb. 15, 1955. 24p. Contract AT-11-1-GEN-8.

The direct determination of boron in uranyl chloride solution is possible without prior removal of uranium. The interference ascribed to the presence of uranium lies in the fact that uranium preferentially combines with the available oxalic acid. If, therefore, a suitable excess of oxalic acid is added the procedure is made useful for the boric acid determination. Sulfates or phosphates should be reduced in content by prior treatment. Nitrates may be removed by ignition, by heating with concentrated hydrochloric acid under reflux, or by reaction with formaldehyde. Calcium chloride may be used to decompose the fluoborate, and the resulting fluoride is removed by filtertration. Uranium metal usually contains only traces of boron. In one special procedure a portion of the metal sample was freed of any boron and used as a blank. In this way as little as 3 ppm of boron were directly determined. Insoluble boron was also determined. (auth)

2164 UCLA-318

Atomic Energy Project, Univ. of Calif., Los Angeles

INSTALLATION AND CALIBRATION OF A STREAMING BIREFRINGENCE APPARATUS. John W. Rowen and Reginald W. Dickinson. Dec. 15, 1954. 30p. Contract AT-04-1-GEN-12.

A birefringence apparatus combining the low-speed characteristics of the Rao apparatus and the high-speed apparatus of Edsall et al has been designed and constructed. Calibration and experience with this apparatus shows it to be easily alignable and easy to maintain in the aligned state. The apparatus has been calibrated using ethyl cinnamate. The extinction angle was 45 ± 1° over the gradient range of 3,000 to 15,000 sec^{-1} and the ΔN over the same range was linear and in agreement with previously published values. Application of the method to three asymmetric molecules shows that lengths can be estimated with ease and changes in molecular length accompanying changes in pH, purification, and ionic strength are truly reflected in the extinction angle-gradient curves. (auth)

2165

A RAPID VOLUMETRIC METHOD FOR THE DETERMINATION OF BERYLLIUM IN BERYLS AND ASSOCIATED MINERALS. M. Sankar Das and V. T. Athavale (Atomic Energy Comm., Bombay, India). Anal. Chim. Acta 12, 6-12(1955) Jan.

A new volumetric method has been proposed for the determination of beryllium in beryls and associate minerals. The method involves the direct precipitation of beryllium as $BeNH_4PO_4 \cdot 6H_2O$ in presence of complexone II, dissolving the precipitate in dilute perchloric acid, and titrating the liberated phosphate with standard bismuthyl perchlorate. Results for samples agree within ± 0.2% of the standard values. (auth)

2166

THE SEMI-MICRO DETERMINATION OF FLUORINE, CHLORINE, AND NITROGEN IN ORGANIC COMPOUNDS.

F. Brown and W. K. R. Musgrave (Univ. of Durham, England). Anal. Chim. Acta 12, 29–33(1955) Jan.

The organic compounds are fused with sodium in a nickel bomb in the usual way, and the fluoride, chloride, and cyanide ions produced are determined. The method cannot be used to determine nitrogen in organic compounds containing oxygen since, in such cases, some of the nitrogen is converted to cyanate ion. (auth)

2167

THE DETERMINATION OF NICKEL WITH DIMETHYLGLYOXIME IN THE PRESENCE OF IRON AND COBALT. E. E. Byrn and J. H. Robertson (Univ. of Tennessee, Knoxville). Anal. Chim. Acta 12, 34–7(1955) Jan.

A method for the determination of nickel in the presence of both ferric iron and cobalt is presented. The nickel is precipitated directly with dimethylglyoxime, without the prior reduction of the iron. The interference of the iron and cobalt is eliminated by the addition of N,N–dihydroxyethylglycine, which chelates the iron and prevents the formation of the iron–cobalt–dimethylgyoxime contaminant. (auth)

2168

DETERMINATION OF THORIUM WITH ORGANIC REAGENTS: USES OF SOME ARYL FATTY ACIDS. Sachindra Kumar Datta and Gurupada Banerjee (Darjeeling Government Coll., India). Anal. Chim. Acta 12, 38–46(1955) Jan.

Phenylacetic–, phenylpropionic–, and 1–naphthylacetic acids show definite promise as precipitating agents for the gravimetric determination of thorium. They can separate thorium from cerite earth and monazite sand, from solutions having thoria: rare earth oxide ration up to 1 : 40, 1 : 16, and 1 : 14, respectively, by a double precipitation method. Foreign ions such as calcium, barium, strontium, titanium, zinc, etc., do not interfere in the determination of thorium by these reagents. As the thorium salts of these three acids are basic in nature, each possessing an entirely different composition, the determination of thorium by direct weighing of the precipitates is not possible and in each case the ignition of the precipitate to thoria is essential. (auth)

2169

HIGH FREQUENCY TITRATIONS INVOLVING CHELATION WITH ETHYLENDIAMINETETRA-ACETIC ACID. II. QUANTITATIVE DETERMINATION OF SOME DIVALENT METALS. Reinosuke Hara and Philip W. West (Louisiana State Univ., Baton Rouge). Anal. Chim. Acta 12, 72–8(1955) Jan.

The high-frequency oscillator provides an excellent means of detecting the endpoints of titrations performed with ethylenediaminetetraacetic acid or its salts. The determination of various divalent metals is reported, based on both direct and indirect titrations. Because of the great sensitivity of the method it is possible to determine cobalt, nickel, copper (II), zinc, cadmium, lead and manganese (II) in concentration ranges of 1/1000 to 1/6000M. (auth)

2170

TRACE–ELEMENT SENSITIVITY: COMPARISON OF ACTIVATION ANALYSIS WITH OTHER METHODS. W. Wayne Meinke (Univ. of Michigan, Ann Arbor). Science 121, 177–84(1955) Feb. 11

Activation analysis is a method for determining the constituents of a sample by utilizing certain nuclear properties of the isotopes of the elements in the sample. Nuclear particles are used to produce radioactive isotopes by activation of the nuclei of the sample elements. These radioisotopes can be detected and measured by their nuclear radiations, and a determination of the amount of element present can be made. The sensitivity of this method was compared with the sensitivity of such standard methods for analysis as copper spark, graphite direct current arc, flame spectrometer, sensitive color reaction, and amperometric titration. Results are presented in tabular form. (C.H.)

2171

DETERMINATION OF SMALL AMOUNTS OF ALUMINIUM IN STEEL BY A SPECTROCHEMICAL METHOD. B. C. Kar (National Metallurgical Lab., Jamshedpur, India). J. Sci. Ind. Research (India) 13, 855–6(1954) Dec.

A method is described for determining small amounts of Al in steel. Standard solutions were prepared by dissolving spectroscopically pure Fe, Mn, and Al in pure HCl. The Al content of the solutions was varied from 0.005 to 0.20%. Test samples were also dissolved. Mn, Fe, and acid content in both sets of solutions were kept uniform and the same volumes of all solutions were used. Spectra of the samples were photographed, and photometric measurements were made. Working curves drawn by plotting the ratio of the log microphotometer deflection of Al line and the log microphotometer deflection of Fe line as a function of the known percentage of Al in the standard solutions. The percentage of Al in the unknown solution was determined by interpolation of its log microphotometer deflection ratio from the working curves. Results of analyses of several samples are presented along with the standard deviations of the results. (M.P.G.)

2172

SPECTROPHOTOMETRIC DETERMINATION OF BISMUTH WITH SODIUM DIETHYLDITHIOCARBAMATE. K. L. Cheng, R. H. Bray, and S. W. Melsted (Univ. of Illinois, Urbana). Anal. Chem. 27, 24–6(1955) Jan.

A simple sensitive procedure has been developed for the spectrophotometric determination of bismuth in the presence of other metals by using a mixture of ethylenediaminetetraacetic acid, cyanide, and ammonium hydroxide. Such a mixture prevents the metals other than bismuth from forming colored complexes with sodium diethyldithiocarbamate. The maximum absorption of the bismuth diethyldithiocarbamate complex in carbon tetrachloride is at 370 mμ. This wave length is the most sensitive, but large amounts of mercury and lead interfere. However, the wave length of 400 mμ, which is less sensitive than 370 mμ, is specific for the bismuth complex. The proposed method should prove useful in determining bismuth in alloys. (auth)

2173

FLAME PHOTOMETRIC STUDY OF BORON. John A. Dean and Clarice Thompson (Univ. of Tennessee, Knoxville). Anal. Chem. 27, 42–6(1955) Jan.

A flame photometric method for boron and its adaption to the Beckman DU spectrophotometer with the Model 9220 flame attachment and photomultiplier unit is discussed. The effects of acid and methanol concentration and of various anions and cations commonly associated with boron upon the flame emission of boron in 1 to 1 methanol–water solution were studied for the three prominent oxide band systems: 492, 518, and 546 mμ. The interference of many elements was of sufficient magnitude to necessitate making a pseudo–background correction by measuring the luminosity at the minima or troughs between the overlapping band systems of boron. Compensation by this means rendered

interference effects by many elements negligible. The flame photometric method is more rapid than existing chemical methods and is comparable in accuracy and precision to them. Optimum range of applicability is 50 to 200 ppm of boron. Sensitivity is within 1 to 3 ppm, depending upon particular phototube response. (auth)

2174

RADIOCHEMICAL DETERMINATION OF CERIUM IN FISSION. L. E. Glendenin, K. F. Flynn, R. F. Buchanan, and E. P. Steinberg (Argonne National Lab., Lemont, Ill.). Anal. Chem. 27, 59-60(1955) Jan.

A simple and rapid radiochemical procedure for the determination of cerium activity produced in nuclear fission is discussed. A method was developed based on solvent extraction of cerium (IV) with methyl isobutyl ketone. Good separation from the large number of elements encountered in fission product sources is afforded by the extraction procedure as well as a considerable saving in time and effort over the ceric iodate precipitation method in previous use. Further applications of the new procedure are the preparation of carrier-free radioactive cerium and activation analysis for small amounts of cerium. (auth)

2175

USE OF FLUOBORIC ACID FOR THE DIRECT DETERMINATION OF POTASSIUM. Harold M. Manasevit (Armour Research Foundation, Chicago, Ill.). Anal. Chem. 27, 81-3 (1955) Jan.

A practical analytical method is proposed for the direct determination of potassium by precipitation as potassium fluoborate from an ice-cold solution. Solutions containing 20 to 250 mg of potassium chloride in the presence of up to 500 mg of sodium chloride have been analyzed, with a relative error in potassium chloride of less than 1% and with good reproducibility. Moderate to comparatively high ratios of the chlorides of copper(II), zinc, cadmium, cobalt, nickel, manganese(II), iron, aluminum, chromium, calcium, lithium, or magnesium to potassium do not interfere. Combinations of these chlorides are permissible; however, aluminum and calcium must not be present in the same solution with potassium. The ammonium, barium, and sulfate ions interfere. (auth)

2176

COLORIMETRIC DETERMINATION OF NIOBIUM IN THE PRESENCE OF TANTALUM. Mohammed Nabi Bukhsh and David N. Hume (Massachusetts Inst. of Tech. Cambridge). Anal. Chem. 27, 116-18(1955) Jan.

The major sources of error in the thiocyanate method for the colorimetric determination of niobium are loss of niobium due to hydrolysis of tantalum present and incomplete extraction of the niobium thiocyanate complex with ether. These effects have been minimized by adding tartaric acid to the reagents, changing the order of additions, and replenishing the thiocyanate and acid between extractions. (auth)

2177

COULOMETRIC DETERMINATION OF ORTHOPHOSPHATE. W. N. Carson, Jr., and H. S. Gile (Hanford Atomic Products Operation, Richland, Wash.). Anal. Chem. 27, 122-3(1955) Jan.

Orthophosphate is determined by passing the sample through a cation exchange column in hydrogen form and determining orthophosphoric acid by differential titration with electrolytically generated base. (auth)

2178

ANALYTICAL PROCEDURES USING A COMBINED COMBUSTION-DIFFUSION VESSEL. AN IMPROVED METHOD FOR THE DEGRADATION OF CARBON-14-LABELED LACTATE AND ACETATE. Joseph Katz, S. Abraham, and I. L. Chaikoff (Univ. of California School of Medicine, Berkeley). Anal. Chem. 27, 155-6(1955) Jan.

Simple combustion-diffusion vessels may be used for the complete degradation of C^{14}-labeled lactate and acetate. The results obtained compare favorably with those of other standard methods. This flask is useful for general degradation procedures of C^{14}-labeled compounds. (auth)

2179

DETERMINATION OF NITROGEN BY THE NUCLEAR REACTION $N_7^{14}(d,n)O_8^{15}$. Pierre Sue. Compt. rend. 240, 88-90 (1955) Jan. 3. (In French)

By determining a relation between the mass of nitrogen, the activity of radiooxygen, and the intensity of the deuteron beam, it is possible to determine the mass of nitrogen present between 6 and 30 mg to an accuracy of ± 20%. In the case of certain metals, it is possible to attain an accuracy of 1 ppm. (tr-auth)

2180

ISOTOPIC GAS ANALYSIS FOR BIOCHEMISTS. R. F. Glascock (Univ. of Reading, England). New York, Academic Press Inc., 1954. 247p.

Gas phase assay of radioactive isotopes of C and H offers the advantages of high efficiency with the possibility of using activities smaller by a factor of at least ten and reduces the necessity for elaborate health precautions. Gas phase assay necessitates the quantitative manipulation of gas samples ranging from as little as 10μl to as much as 100 ml and the evacuation to very low pressures of the counters and ionization chambers used for the radioactive measurements. The advantages of this type of analysis in biochemical work are discussed, apparatus is described, and specific directions are included covering gas phase assay of C^{14}, combustion of labeled compounds, methods for the determination of deuterium and tritium, the preparation of heavy nitrogen samples for mass spectrometric analysis, the preparation of tritium-labeled compounds, and in vitro oxidation studies. (C.H.)

DEUTERIUM AND DEUTERIUM COMPOUNDS

2181 MLM-934

Mound Lab.

THE PHYSICAL PROPERTIES OF HEAVY WATER FROM ROOM TEMPERATURE TO 250°C. J. R. Heiks, M. K. Barnett, L. V. Jones, and E[dward] Orban. Jan. 12, 1954. 16p. Contract AT-33-1-GEN-53.

The density and viscosity of 99.20% deuterium oxide has been determined from 30 to 250°C while surface tension measurements were made from 100°C to 216°C. A bob suspended from a 200-micron fused quartz fiber spiral inside of a pressure vessel was used to determine densities to the nearest 0.0003 g/cc. The ratio of the densities of deuterium oxide to ordinary water increases with temperature up to about 80°C, but decreases with further increases in temperature. A Lawaczeck falling body viscometer, in which the time of fall of a radioactive plummet was measured with the use of coincident counting tubes, showed the viscosity of deuterium oxide to be 21% higher than ordinary water at 30°C while at 250°C this difference de-

creased to 9.7%. The height of rise of liquid in a capillary tube showed that the surface tension of deuterium oxide and ordinary water are about the same at 100°C, but with increasing temperature the surface tension for deuterium oxide becomes increasingly less until at 220°C it is about 3% less than the value for ordinary water. (auth)

2182

THE EFFECTS OF CERTAIN NITRO AND RELATED COMPOUNDS UPON THE RATE OF EXCHANGE OF DEUTERIUM GAS WITH ACETIC ACID OVER ADAMS PLATINUM CATALYST. Nilton A. Smith and Edgar L. McDaniel (Univ. of Tennessee, Knoxville). J. Am. Chem. Soc. 77, 533–5 (1955) Feb. 5.

The effect of a nitro compound upon the rate of catalytic exchange of deuterium and acetic acid is determined by the remainder of the molecule. Where the nitro group is conjugated with an olefinic bond, the rate of exchange is accelerated by the addition of these compounds in low concentration. In more concentrated solutions of these compounds no exchange occurs initially, although exchange does occur after reduction of the nitro compound. Oximes derived by partial reduction of the nitro compounds in which the nitro group is conjugated with an olefinic bond increase the rate of exchange to values near those maxima exhibited by the parent nitro compounds. (auth)

FLUORINE AND FLUORINE COMPOUNDS

2183

VIBRATIONAL INTENSITIES. IV. BOND MOMENTS IN C_2F_6. Dale G. Williams, Willis B. Person, and Bryce Crawford, Jr. (Univ. of Minnesota, Minneapolis). J. Chem. Phys. 23, 179–84(1955) Jan.

The intensities of four of the infrared-active fundamentals of C_2F_6 were determined and interpreted in terms of the bond-momemt hypothesis. The bond-moment parameters are overdetermined so that an internal check is provided. This check, supplemented by comparison with data on related molecules, shows that the bond-moment picture is a useful approximation but that it is not quantitatively reliable. (auth)

2184

THE MICROWAVE SPECTRUM OF ETHYL FLUORIDE. J. Kraitchman and B. P. Dailey (Columbia Univ., New York). J. Chem. Phys. 23, 184–90(1955) Jan.

The microwave spectrum of ethyl fluoride has been investigated in the region from 17 to 38 kMc. The values of the rotational constants of the molecule obtained from the analysis of the spectrum are: A = 36070.30 ± 0.10 Mc, B = 9364.54 ± 0.10 Mc, and C = 8199.74 ± 0.10 Mc. The following structural parameters have been fitted to these rotational constants: r_{CH} = 1.091A, r_{CC} = 1.540A, r_{CF} = 1.375A, and tetrahedral bond angles. The dipole moment components along the principle axes of the molecule are μ_A = 1.69D and μ_B = 1.00D; the total dipole moment, μ = 1.96 ± 0.03D, is oriented at an angle of 64° with respect to the C–C bond axis, or approximately 7° from the C–F bond axis. The barrier height for internal rotation is 1490 ± 50 cm^{-1} (4260 cal/mole). (auth)

2185

DIVALENT HYDROGEN IN THE FHF^- ION. R. T. Sanderson (State Univ. of Iowa, Iowa City). J. Chem. Phys. 23, 217(1955) Jan.

The charge distribution in FHF^- ion with reference to the divalency of the hydrogen and the stability of the bonds in KFHF is briefly discussed. In addition, the reaction of a molecule of Hf with a F^- ion and the chemical reasonableness of the FHF^- ion are discussed. (J.A.G.)

2186

DETERMINATION OF CARBON AND FLUORINE IN HIGHLY FLUORINATED SUBSTANCES. H. E. Freier, B. W. Nippoldt, P. B. Olson, and D. G. Weiblen (Minnesota Mining and Manufacturing Co., St. Paul). Anal. Chem. 27, 146–9 (1955) Jan.

In a general method for the determination of carbon and fluorine in organic compounds containing a high percentage of fluorine, a combustion procedure is used in which the sample is burned with moist oxygen in a quartz tube. Gases, liquids, and solids can be handled. The fluorine is determined by an acid–base titration of the hydrofluoric acid formed and the carbon, which is simultaneously converted to carbon dioxide, is absorbed by Ascarite. Carbon and fluorine can be determined in a large variety of compounds with a relative error of less than 1%. (auth)

2187

CHLORYL FLUORIDE AND ITS DERIVATIVES. A. A. Woolf (Univ. of Manchester, England). J. Chem. Soc. (London), 4113–16(1954) Dec.

A new preparation of chloryl fluoride from alkali chlorates and bromine trifluoride is reported. The fluoride forms solid 1 : 1-compounds with boric and antimonic fluorides. These are regarded as chloronium (ClO_2^+) salts. The preparation of other oxy-halogen cations is discussed. (auth)

2188

COMPLEX FLUORIDES OF IRIDIUM AND OSMIUM. M. A. Hepworth, P. L. Robinson, and G. J. Westland (King's Coll., Newcastle-on-Tyne, England). J. Chem. Soc. (London), 4269–75(1954) Dec.

Complex fluorides of the general formula M(I)M(V)F_6, where M(I) = Li, Na, K, Rb, Cs, Ag, and M(V) = Ir, Os, involving quinquevalent iridium and osmium have been prepared and characterized. Further, the preparation of complexes of the formula $M(I)_2M(IV)F_6$, where M(I) = K, Cs, and M(IV) = Ir, Os, is also described. Evidence is presented to show that complexes of the types M(I)IrF_7 and M(I)OsF_9, where M(I) = Na, K, do not exist. (auth)

2189

THE REACTIONS OF HIGHLY FLUORINATED ORGANIC COMPOUNDS. PART VII. 1 : 2-DICHLORODECAFLUOROCYCLOHEXANE AND DERIVED COMPOUNDS. J. Roylance, J. C. Tatlow, and R. E. Worthington (Univ. of Birmingham, England). J. Chem. Soc. (London), 4426–9 (1954) Dec.

1, 2-Dichlorodecafluorocyclohexane, prepared by addition of chlorine to perfluorocyclohexene, gave, with lithium aluminium hydride, 1H, 2H-decafluorocyclohexane. This product, together with other isomers, has been obtained also by reduction of the dichlorodecafluorocyclohexane formed by reaction of p-dichlorobenzene with cobaltic fluoride. 1H, 2H-Decafluorocyclohexane, when treated with aqueous alkali, afforded 1H-nonafluorocyclohexene, which on oxidation gave perfluoroadipic acid. (auth)

2190

THE STRUCTURE OF TITANIUM OXYDIFLUORIDE. Karl Vorres and Jerry Donohue (Univ. of Southern California, Los Angeles). Acta Cryst. 8, 25–6(1955) Jan.

The structure of titanium oxydifluoride, $TiOF_2$, has been

determined from x-ray powder photographs. The structure consists of titanium atoms octahedrally coördinated by randomly distributed oxygen and fluorine atoms, these octahedra sharing all six corners with neighboring octahedra. It is shown that powder data previously attributed to TiF_4 are probably due to $TiOF_2$. (auth)

GRAPHITE

2191

THE VALENCE BANDS IN TWO-DIMENSIONAL GRAPHITE. W. M. Lomer (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Roy. Soc. (London) A227, 330-49(1955) Jan. 20.

A group-theoretical treatment of the spatial symmetry of two-dimensional graphite leads to a classificaion of the one-electron eigenstates. The method of idempotent operators is used to derive Bloch orbitals for the crystal valence bands as a linear combinations of the atomic orbitals $2p_x$, $2p_y$ and $2s$. The functions $2p_z$ form the conduction band. The energy of the electrons in such orbitals is estimated in terms of four overlap integrals between nearest neighbor atoms, and four corresponding Hamiltonian integrals. The deduced band structure is not sensitive to the precise values of these integrals, and cannot be changed materially by the inclusion of further neighbors. The states form three touching bands, all fully occupied by electrons in the normal structure. The large band width of some 10 ev affects previous discussions of soft x-ray experiments. (auth)

2192

THE STRUCTURE OF THE π-BAND OF GRAPHITE. D. F. Johnston (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Roy. Soc. (London) A227, 349-58 (1955) Jan. 20.

A three-dimensional tight-binding model of graphite, based on the $2p_z$ atomic orbital of carbon, is used to calculate the energy of the π conduction states near the Fermi surface. The results of a group-theoretical analysis of the problem are used to simplify the calculation. The energy is obtained as a four-valued function of the k-vector within a primitive unit cell in the reciprocal lattice. It is found that the first and second of these bands of states are almost fully occupied, while the third and fourth are almost empty. The lowest energy of the third band is about 4×10^{-3} ev below the highest energy of the second band, so there are 'free' electrons even at absolute zero. Explicit formulas are given for the energy of the states within the region occupied by the Fermi surface at temperatures below 100°K. For temperatures above 100°K, or if electron traps are present, the energy distribution with the region occupied by the Fermi surface is tabulated in detail. This knowledge of the conduction states of graphite is used in a subsequent paper to calculate the Hall coefficient of a single crystal of graphite and is found to give good agreement with experiment. (auth)

2193

A THEORY OF THE HALL EFFECT IN GRAPHITE. D. F. Johnston (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Roy. Soc. (London) A227, 359-67 (1955) Jan. 20.

The Hall coefficient and chemical potential of an infinite single crystal of graphite are obtained as numerical functions of temperature and the number of electron traps. The results are compared with experiment. (auth)

LABORATORIES AND EQUIPMENT

2194 DP-99

DuPont de Nemours, E. I., and Co. Explosives Dept. Atomic Energy Div.

A REMOTELY CONTROLLED METALLOGRAPH. J. D. Ross. Jan. 1955. 15p. Contract AT(07-2)-1.

A metallograph, equipped with a remote viewing periscope, was purchased from the Bausch and Lomb Company. Seven of the controls were adapted for remote operation to permit the use of the instrument in examining highly radioactive materials behind shielding. These controls are driven at their optimum speed by small electric motors mounted on the metallograph. The speed and direction of rotation of each motor is controlled from a panel located near the eyepiece of the periscope. Satisfactory performance of the modified metallograph was demonstrated. (auth)

2195 UCRL-2837

Radiation Lab., Univ. of Calif., Berkeley

A METHOD OF DEGASSING LIQUIDS. Amos S. Newton. Jan. 13, 1955. 10p. Contract W-7405-eng-48.

An apparatus is described for the complete degassing of liquids which have low vapor pressures at their freezing points. A modification of the apparatus for the complete recovery of traces of dissolved gases in liquids has been illustrated with the recovery of 0.126 millimole of a mixture of propene, propane, isobutene, and isobutane from di-isopropyl ether. (auth)

2196

A MULTI-RANGE LABORATORY FLOWMETER. K. H. Todhunter and B. Wolstenholme (Simon-Carves Ltd., Cheadle Heath, Stockport, England). J. Sci. Instr. 32, 35(1955) Jan.

A flowmeter arrangement is described which avoids the difficulty of exchanging capillaries and manometer fluid in measuring a wide range of flows in the same experiment. The capillary tubing is placed by a glass cock of suitable dimensions, the pressure drop across which varies with the available free cross-sectional area for flow. By selecting different positions of the cock, a multi-range flowmeter is obtained. (L.T.W.)

RADIATION CHEMISTRY

2197 UCRL-2631

Radiation Lab., Univ. of Calif., Berkeley

INDIRECT AND DIRECT ACTION OF HEAVY-PARTICLE RADIATION ON ACETIC ACID IN AQUEOUS SOLUTION. Warren M. Garrison, Winifred Bennett, Sybil Cole, Herman R. Haymond, and Boyd M. Weeks. Dec. 14, 1954. 25p. Contract W-7405-eng-48.

Chemical reactions induced by heavy-particle irradiation of acetic acid—water mixtures in the concentration range 0.0625 to 16M have been studied. The principal products formed in dilute, oxygen-free acetic acid solutions at radiation doses below 5×10^{20} ev/ml are hydrogen, hydrogen peroxide, and succinic acid. Carbon dioxide, methane, ethane, and carbon monoxide are also produced. The radiation yields of all products increase with acetic acid concentration in the range 0.0625 to 1.0M With increasing acetic acid concentration above 1.0M a continuous decrease in G values for hydrogen, hydrogen peroxide, and succinic acid is observed. Values for the latter two products decrease essentially to zero in 16M acetic acid. Radiation

yields of carbon dioxide, methane, ethane, and carbon monoxide, however, increase continuously with acetic acid concentration. With the exception of ethane, G values for these products show a linear dependency on acetic acid concentration. Mechanisms are proposed for both the indirect and direct action of radiation on the acetic acid molecule. (auth)

2198 UCRL-2794

Radiation Lab., Univ. of Calif., Berkeley

EFFECTS OF IONIZING RADIATION ON CHOLINE CHLORIDE AND ITS ANALOGS. Richard M[illington] Lemmon, Margaret A. Parsons, and Doris M. Chin. Dec. 1954. 11p. Contract W-7405-eng-48.

Choline chloride and six analogs have been exposed in the dry, crystalline state to high-energy electron and gamma radiation. This investigation has confirmed the abnormal radiation sensitivity of choline chloride. Its G values (molecules decomposed/100 ev) were found to be: e^--radiation, 20; γ-radiation, 175. These high values indicate a chain mechanism for the solid-state reaction. The G values for the choline analogs were found to range from 1 to 18 for the electron irradiations and from 1 to 32 for the gamma irradiations. Betaine hydrochloride approaches choline chloride in instability toward high-energy electrons but is far more stable in the presence of γ-rays. (auth)

2199

ACTION OF IONIZING RADIATIONS ON CATALASE IN PRESENCE OF CYSTEINE, CYSTINE AND GLUTATHIONE. W. M. Dale and C. Russell (Christie Hospital and Holt Radium Inst., Manchester, England). Nature 175, 33-4 (1955) Jan. 1.

Beef liver catalase was exposed to the γ radiation from Co^{60} and to high-energy electrons from a linear electron accelerator alone and in the presence of cysteine, cystine, and glutathione. Data are presented on the resultant effects on the enzymatic activity, electrophoretic behavior, chromatographic behavior, and the ultraviolet absorption pattern. The catalase was protected against γ radiation and high-energy electrons by cysteine, cystine, and glutathione. (C. H.)

2200

RADIATION-CHEMICAL STUDIES WITH CYCLOTRON BEAMS. Robert H. Schuler and Augustine O. Allen (Brookhaven National Lab., Upton, N. U.). J. Am. Chem. Soc. 77, 507(1955) Jan 20.

2201

IRRADIATION OF FERROUS AMMONIUM SULFATE SOLUTIONS: ENERGY ABSORPTION AND IONIZATION CALCULATIONS FOR COBALT-60 AND BETATRON RADIATION. D. V. Cormack, R. W. Hummel, H. E. Johns, and J. W. T. Spinks (Univ. of Saskatchewan, Saskatoon, Canada). J. Chem. Phys. 23, 162-4(1955) Jan. (cf. NSA 8-2141)

G values for the irradiation of ferrous ammonium sulfate by Co^{60} and betatron radiation were recalculated taking into account wall effects which were neglected in the original paper. (J. Chem. Phys. 22, 6(1954). (auth)

2202

DECOMPOSITION OF METHYL ALCOHOL BY Co^{60} GAMMA RADIATION. William R. McDonell and Sheffield Gordon (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 23, 208(1955) Jan.

The yields of decomposition products resulting from Co^{60} gamma irradiation of methanol were determined. The dosage ratio was 2.4×10^{20} ev/l-min. Gaseous decomposition products, H_2, CO, CH_4, were measured on samples irradiated from 15 to 60 min at room temperature. Oxidation products, formaldehyde and ethylene glycol, were determined in the liquid phase on samples irradiated from 1 to 5 days at room temperature. The decomposition products determined were all formed linearly with irradiation dosage, and yields were derived from the slopes of the irradiation curves. The decomposition product yields by Co^{60} gamma radiation and by 28 Mev He ions are tabulated. The difference in the ratio of ethylene glycol and formaldehyde in the two type of irradiations, and the reactions occuring in the formation of each are discussed. A single α irradiation conducted at O°C resulted in a yield of formaldehyde equal to that obtained at room temperature (1.3 ± 0.1 molecules/100 ev), while ethylene glycol was produced with a yield of 2.4 ± 0.2 molecules/100 ev, appreciably lower than the room temperature yield (3.0 ± 0.2 molecules/100 ev). J.A.S.

2203

DECOMPOSITION OF METHYL ALCOHOL–WATER SOLUTIONS BY Co^{60} GAMMA RADIATION. William R. McDonell (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 23, 208-9(1955) Jan.

The yields of formaldehyde and ethylene glycol resulting from Co^{60} gamma irradiation for 1 to 5 days of methyl alcohol–water solutions were determined over the composition range 100 to 1 vol. % methyl alcohol by the dimedone method. The product concentrations ranged from 0.001 to 0.100M, and, in general, were proportional to the length of time of irradiation, with the possible exception of formaldehyde. Specific yield values were taken from the slopes of curves representing the build-up of product as the irradiations proceeded. Where specific yields were plotted against the partial density of methanol molecules, expressed as a percentage of that in pure CH_3OH, the formaldehyde was shown to fall off linearly with decreasing methanol, while ethylene glycol remained at a high value down to rather low alcohol concentrations. Results also indicate that formaldehyde formation is a rapid high-activation-energy process while glycols are formed characteristically in relatively homogeneous solution by reaction of CH_2OH radicals, produced either through radiation activation or by free radical attack. (J.A.G.)

RARE EARTHS AND RARE-EARTH COMPOUNDS

2204

HYPERFINE STRUCTURE OF Tm SPECTRA AND THE NUCLEAR MOMENTS OF Tm^{169}. Karl Heinz Lindenberger and Andreas Steudel (Physikalisches Institut der Universität, Heidelbeig, German). Naturwissenschaften 42, No. 2, 41-2(1955) Jan. (In German)

2205

PREPARATION OF A DEFINITE CERIUM HYDRIDE CeH_3 AND THE DETECTION OF THE EXISTENCE OF CeH_2. K. Dialer and W. Rothe (Institut fur Technische Chemie der Technischen Hochschule, Hannover, Germany). Naturwissenschaften 42, No. 2, 44-5(1955) Jan. (In German)

2206

THE PREPARATION OF SAMARIUM METAL WITH CALCIUM. E. I. Onstott (Los Alamos Scientific Lab., New Mexico). J. Am. Chem. Soc. 77, 812-13(1955) Feb. 5.

The method described for the preparation of massive Sm metal is similar to those reported by Daane et al.(J. Am. Chem. Soc. 75, 2272(1953)) and Onstott (J. Am. Chem. Soc. 75, 5728 (1953)), except that Ca is used as the reductant instead of La. (L.M.T.)

SEPARATION PROCEDURES

2207 AECU-2989

Institute for the Study of Rate Processes, Univ. of Utah

THE RECOVERY OF METALS FROM SULFIDE ORES BY HIGH TEMPERATURE-HIGH PRESSURE TECHNIQUES. I. LEACHING OF MOLYBDENITE. William H. Dresher, W. Martin Fassell, Jr., and Milton E. Wadsworth. Dec. 1, 1954. 18p. Contract AT(11-1)-82, Technical Report No. 14.

The rates of leaching of molybdenite (MoS_2) in a solution of potassium hydroxide were determined in the temperature range of 100 to 200°C under an oxygen partial pressure of 0 to 920 psig. Under all conditions studies the leaching followed a linear mechanism. The apparent activation energy was found to be 14.2 kcal per mole. The pressure dependency of the reaction was found to be a complex function of the oxygen over pressure. (auth)

2208 ORO-135

Virginia Polytechnic Inst.

MASS TRANSFER IN A HORIZONTAL LIQUID-LIQUID EXTRACTION TUBE. Nelson F. Murphy, John E. Lastovica, and Adam E. Skrzec. [1954]. 42p. Contract AT(40-1)-1442.

The properties affecting the film coefficients of mass transfer and the correlation of the properties of the system and of the operational variables which will enable one to predict approximately the values of the coefficients are discussed. Mass transfer data and calculated results for 1-butanol—water, cyclohexanol—water, furfural—water, nitromethane—water, and methyl ethyl ketone—water systems are tabulated. The quantities of each solvent and water entering and leaving the extraction tube were determined from the flow rates and compositions of the inlet and outlet streams. The quantities of solvent transferred into the water and water transferred into the solvent phase were found. The concentration differences were calculated from the solubility limits and the experimentally determined composition of the entering and leaving streams. The average concentration differences are logarithmic when the ratios of these differences are more than 1.8. (J.A.G.)

2209

AN ATTEMPT TO SEPARATE TITANIUM FROM OXYGEN BY VACUUM SUBLIMATION; AND SOME MEASUREMENTS OF EVAPORTION RATES. A. B. Osborn (Royal Aircraft Establishment, Farnborough, Hants, England). J. Inst. Metals 83, 185-8(1955) Jan.

Titanium samples containing 2, 6, and 16 wt.% oxygen were prepared. Each sample was heated in vacuo until it evaporated freely at 1500 to 1600°C. The vapor was condensed and examined for oxygen. In each case, the sublimate contained substantially less oxygen than the alloy from which it was evaporated. This process is unattractive for the industrial purification of titanium, since it requires an excessive use of electrial energy. The evaporation rate, at 1530°C, of titanium containing 6 wt.% oxygen was found to be approximately equal to the published rate for pure titanium, but from the sample containing 16 wt.% oxygen, evaporation proceeded at about one-seventh of the normal rate. Titanium containing 6.25 wt.% oxygen had previously been reported to be much more volatile than other titanium—oxygen alloys. This report was not confirmed. (auth)

2210

STUDIES ON SOME PHYSICO-CHEMICAL PROPERTIES OF ION-EXCHANGE RESIN. I. HEAT OF WETTING. Tatsuo Matsuura (Rikkyo Univ., Japan). Bull. Chem. Soc. Japan 27, 281-7(1954) July.

The measurement of heats of wetting of strongly acidic and weakly acidic cation exchange resins and strongly basic anion exchange resins was studied. Their great dependence on the absorbed ion species was found. (auth)

2211

SEMIAUTOMATIC GAS SEPARATION EQUIPMENT. Charles W. Hancher and Karl Kammermeyer (State Univ. of Iowa, Iowa City). Anal. Chem. 27, 83-7(1955) Jan.

With manual operation of apparatus for gas separation, the chance of introducing errors is great. A simultaneous-sampling, double automatic gas buret apparatus was developed whereby one operator could handle the equipment with a greater degree of accuracy because the timing and pressure control are automatic. Experimental data with the described instrument agreed well with data obtained from the manually operated apparatus and less time was required per determination. (auth)

2212

ANION-EXCHANGE STUDIES. XII. ABSORPTION OF ACIDS BY STRONG BASE ANION-EXCHANGE RESINS IN POLYVALENT FORMS. SEPARATION OF WEAK AND STRONG ACIDS. Frederick Nelson and Kurt A. Kraus (Oak Ridge National Lab., Tenn). J. Am. Chem. Soc. 77, 329-31(1955) Jan. 20.

2213

ANION EXCHANGE STUDIES. XIII. THE ALKALINE EARTHS IN CITRATE SOLUTIONS. Frederick Nelson and Kurt A. Kraus (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 77, 801-4(1955) Feb. 5.

The anion-exchange behavior of the alkaline earths was studied in citrate solutions with a strong base anion-exchange resin. The elements were found to adsorb, and there were sufficient differences in their adsorbabilities to permit their separation from each other. In addition, separation of the alkaline earths from alkali metals, rare earths and a few other elements was demonstrated. The implications of the anion-exchange results on the strength and composition of citrate complexes of the alkaline earths are discussed. (auth)

2214

ANION-EXCHANGE STUDIES. XIV. THE ALKALI METALS IN ETHYLENEDIAMINETETRAACETIC ACID SOLUTIONS. Frederick Nelson (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 77, 813-14(1955) Feb. 5

Experiments on the anion exchange separation of Cs, Na, and Li in EDTA were carried out with a Dowex-1 resin of 4% cross-linking and mesh size 50 to 100. At 2.5×10^{-3}M EDTA and pH = 10.9, Cs appeared in the effluent first, and was satisfactorily separated from Na which was slightly retained. Satisfactory elution of Li was achieved with 0.25M EDTA and pH = 4.2, the appearance of Li paralleling a gradual decrease in pH. (L.M.T.)

2215

CONDUCTOMETRIC DETERMINATION OF IONS IN

PAPERCHROMATOGRAMS. G. De Vries and E. Van Dalen (Chemisches Laboratorium der Freien Universitat, Amsterdam, Netherlands). Rec. trav. chim. 73, 1028-32(1954) Nov. (In Dutch)

Good separation of the chlorides and perchlorates of alkali metals was obtained by paper chromatography, but identification was difficult. An apparatus is described with which the ions are found on the basis of the passage of current through the spots. The optimum voltage range and the sensitivity of the method for Li, Na, and K ions, individually and together, are discussed. (tr-auth)

SORPTION PHENOMENA

2216

THE DETERMINATION OF PORE SIZE DISTRIBUTION AND SURFACE AREA FROM ADSORPTION ISOTHERMS. E. M. Voigt and R. H. Tomlinson (McMaster Univ., Hamilton, Ontario, Canada). Can. J. Chem. 33, 215-31(1955) Feb.

Theoretical isotherms have been developed which, when compared to experimental isotherms showing hysteresis, allow the calculation of pore size, pore size distribution, and surface area of the sorbent. Interpretation of some experimental isotherms obtained with porous vycor glass shows that this system can best be represented by the "ink bottle" pore model with a Gaussian distribution of pore sizes. The mean pore radius of the porous glass is about two thirds of the Kelvin radius, and the surface area greater than that obtained from the B.E.T. theory. The Kelvin radius is interpreted as a weighted average, but the B.E.T. surface area appears more fundamentally different. (auth)

SPECTROSCOPY

2217

THE PURE ROTATIONAL SPECTRA OF DBr, HI, AND DI IN THE SPECTRAL REGION BETWEEN 45 AND 170 MICRONS. E. D. Palik (Ohio State Univ., Columbus). J. Chem. Phys. 23, 217-18(1955) Jan.

The preparation and pure rotational spectra of CBr, HI, and DI in the spectral region between 45 and 170μ obtained with an infrared spectrograph are reported. The frequencies of the pure rotational lines of a diatomic molecule are given by the formula $\nu = 2B_0J' - 4D_0J'^3$ where ν is the frequency of the line in kaysers. B_0 is the rotational constant or the reciprocal of inertia of the molecule in the ground state, D_0 is the centrifugal stretching constant for the ground state, and J' is the usual rotational quantum number associated with the upper energy level of the transition. Values of B_0 and D_0 were chosen to fit the observed lines of each molecule. The pure rotational line, rotational constants, and centrifugal stretching constants of DBr, HI, and DI are tabulated. (J.A.G.)

SYNTHESES

2218 UCRL-4426

Radiation Lab., Univ. of Calif., Livermore

THE DECOMPOSITION OF TETRAALKYLAMMONIUM AMIDES AND TETRAETHYLAMMONIUM IN LIQUID AMMONIA. THE PREPARATION OF A SUBSTITUTED AMMONIUM AMIDE. William L. Jolly. Dec. 17, 1954. 12p. Contract W-7405-eng-48.

The over-all decomposition of tetraethylammonium in liquid ammonia involves the formation of triethylamine, hydrogen, ethylene and ethane. The hydrogen comes from the reaction of electrons with the solvent to form amide ions; the triethylamine and ethylene are formed from the reaction between amide ions and tetraethylammonium ions, and the ethane is produced by the hydrogenation of the ethylene. The reactions of tetraalkylammonium ions with amide ions have been studied; it has been shown that the tetraethylammonium ion is stable in the presence of the diphenylamide ion or the anilide ion. Tetraethylammonium diphenylamide has been prepared and characterized. (auth)

2219

THE PREPARATION OF POLONIUM METAL AND POLONIUM DIOXIDE. K. W. Bagnall and R. W. M. D'Eye (Atomic Energy Research Establishment, Harwell, Berks, England). J. Chem. Soc. (London), 4295-9(1954) Dec.

Milligram amounts of very pure metallic Po^{210} have been prepared by vacuum-sublimation of polonium deposited on silver, nickel and platinum. A similar procedure using polonium deposited on copper yielded a mixture of metallic polonium and cuprous chloride. An oxide has been prepared, which, from its chemical behaviour, is considered to be PoO_2. The crystal structures of the two modifications of this oxide have been determined. (auth)

2220

A NEW PYRIDINE COMPLEX OF SELENIUM TETRAFLUORIDE. E. E. Aynsley and G. Hetherington (King's Coll., Newcastle-on-Tyne, England). J. Chem. Soc. (London), 4695-6(1954) Dec.

2221

THE ELECTROLYTIC PREPARATION OF MOLYBDENUM FROM FUSED SALTS. I. ELECTROLYTIC STUDIES. Seymour Senderoff and Abner Brenner (National Bureau of Standards, Washington, D. C.). J. Electrochem. Soc. 101, 16-27(1954) Jan.

Potassium hexachloromolybdate (III), K_3MoCl_6, dissolved in molten alkali halides may be electrolyzed to deposit pure molybdenum at the cathode. The effect of the operating variables on the nature of the deposit is discussed. (auth)

2222

THE ELECTROLYTIC PREPARATION OF MOLYBDENUM FROM FUSED SALTS. II. THE PREPARATION OF REDUCED MOLYBDENUM HALIDES. Seymous Senderoff and Abner Brenner (National Bureau of Standards, Washington, D. C.). J. Electrochem. Soc. 101, 28-30 (1954) Jan.

An improved method for the preparation of potassium hexachloromolybdate (III), K_3MoCl_6, is described. Potassium molybdate is dissolved in hydrochloric acid and the solution electrolyzed in a divided cell. Hydrogen chloride gas is then added to the catholyte to precipitate K_3MoCl_6. A new method for preparing molybdenum dichloride, $(MoCl_2)x$, is described. Molybdenum pentachloride is reduced with molybdenum powder to the trichloride. This is then heated to produce the molybdenum dichloride by thermal dissociation. (auth)

2223

ELECTROLYTIC PREPARATION OF MOLYBDENUM FROM FUSED SALTS. IV. PREPARATION OF REDUCED MOLYBDENUM CHLORIDES FROM MOLYBDENITE CONCENTRATE. Seymour Senderoff and Roger J. Labric (National Bureau of Standards, Washington, D. C.). J. Electrochem. Soc. 102, 77-80(1955) Feb.

Commercial molybdenite concentrates are chlorinated to

produce molybdenum pentachloride and sulfur chlorides. Sulfur chlorides are removed and molybdenum pentachloride is reduced either electrolytically in aqueous solution or by reaction with a hydrocarbon in a nonaqueous system. The aqueous reduction product is recovered as potassium hexachloromolybdate(III), K_2MoCl_6, and the hydrocarbon reduction product is recovered, after heating, as molybdenum trichloride. Either of these salts may be dissolved in alkali halides and electrolyzed to deposit molybdenum metal at the cathode. (auth)

2224

THE REACTION OF THORIUM NITRATE TETRAHYDRATE WITH NITROGEN OXIDES. ANHYDROUS THORIUM NITRATE. John R. Ferraro, Leonard I. Katzin, and George Gibson (Argonne National Lab., Lemont, Ill., and Illinois Inst. of Tech., Chicago). J. Am. Chem. Soc. 77, 327-9 (1955) Jan. 20.

Procedures for the preparation of anhydrous thorium nitrate were investigated. Of these only the reaction of thorium nitrate tetrahydrate with dinitogen pentoxide in anhydrous HNO_3 to form $Th(NO_3)_4 \cdot 2N_2O_5$ was completely successful. The thermal decomposition of $Th(NO_3)_4 \cdot 2N_2O_5$ yielded anhydrous thorium nitrate. (J. E. D.)

URANIUM AND URANIUM COMPOUNDS

2225

CRYSTAL CHEMICAL STUDIES OF THE 5f-SERIES OF ELEMENTS. XX. THE CRYSTAL STRUCTURE OF TRIPOTASSIUM URANYL FLUORIDE. W. H. Zachariasen (Argonne National Lab. and Univ. of Chicago, Ill.). Acta Cryst. 7, 783-7(1954) Dec.

$K_3UO_2F_5$ is tetragonal with $a_1 = 9.160 \pm 0.001$, $a_3 = 18.167 \pm 0.002$ A, and eight stoichiometric molecules per unit cell. The space group is $I4_1/a$. The positions of all light atoms have been determined with considerable accuracy with the aid of precise intensity measurements on a small spherical crystal and a series of generalized Fourier syntheses. The structure is built up of $(UO_2F_5)^{-3}$ complexes held together by potassium ions. The (UO_2F_5) group has the shape of a pentagonal bipyramid, the five fluorine atoms forming a nearly regular pentagon normal to the axis of the uranyl group. The bond lengths are U–O = 1.76 ± 0.03 A and U–F = 2.24 ± 0.02 A. (auth)

2226

CRYSTAL CHEMICAL STUDIES OF THE 5f-SERIES OF ELEMENTS. XXI. THE CRYSTAL STRUCTURE OF MAGNESIUM ORTHOURANATE. W. H. Zachariasen (Argonne National Lab. and Univ. of Chicago, Ill.). Acta Cryst. 7, 788-91(1954) Dec.

Magnesium orthouranate, $Mg(UO_2)_2$, is found to be orthorhombic body centered with four stoichiometric molecules in a unit cell of dimensions $a_1 = 6.520$ A, $a_2 = 6.595$ A, $a_3 = 6.924$ A. The space group is Iman. The structure is of a type not previously encountered for orthouranates, containing endless chains UO_2O_2 rather than the endless layers hitherto observed. The structure contains collinear uranyl groups with U–O = 1.92 ± 0.03 A. Uranium forms four secondary U–O bonds in the plane normal to the uranyl group, these bond lengths being 2.16 ± 0.03 A and 2.20 ± 0.03 A. The six oxygen atoms about each uranium atom form a distorted octahedron, and these octahedra share edges with one another to form endless chains UO_2O_2 parallel to the a_3 axis. The orthouranate chains are linked together by the magnesium atoms, each magnesium atom being bonded to six oxygen atoms belonging to four different chains. The Mg–O bond lengths are 1.98 ± 0.01 A (twice) and 2.19 ± 0.02 A (four times). (auth)

2227

CRYSTAL CHEMICAL STUDIES OF THE 5f-SERIES OF ELEMENTS. XXII. THE CRYSTAL STRUCTURE OF K_3UF_7. W. H. Zachariasen (Argonne National Lab. and Univ. of Chicago, Ill.). Acta Cryst. 7, 792-4(1954) Dec.

K_3UF_7 can be prepared in an ordered and in a disordered form. The ordered form is tetragonal and isostructural with the compound $K_3UO_2F_5$. The unit-cell dimensions are $a_1 = 9.22$ A, $a_3 = 18.34$ A. The structure contains complexes $(UF_7)^{-3}$ having the shape of pentagonal bipyramids with U–F = 2.26 A. The disordered form is cubic face centered with a = 9.22 ± 0.02 A and four molecules per unit cube. It is proposed that the structure contains UF_7 complexes of the same shape and dimensions as observed in the ordered form, but that there is some randomness as to the orientation of these complexes. The compounds $(NH_4)_3ZrF_7$ and K_3ZrF_7 are isostructural with the disordered form of K_3UF_7. (auth)

2228

VOLUMETRIC DETERMINATION OF URANIUM IN POOR ORES. W. M. Smit and J. Klinkhamer (State Univ., Utrecht, Netherlands). Rec. trav. chim. 73, 1009-21(1954) Nov. (In English)

The conditions necessary to prevent interference of Fe with the oxidimetric titration of U were derived on the basis of calculations regarding the relations between the redox potential and the pH. The method of calculation may be applied to other possibly interfering ions. It is shown that a successful determination of both U and Fe can be carried out in a solution with an atomic ratio Fe/U of 1000 and containing only 2 mg of U per 150 ml. By using the dead stop end point indication method, U and Fe may be determined separately without previous separation and without any pretreatment but reduction by a common Jones reductor. (auth)

ENGINEERING

HEAT TRANSFER AND FLUID FLOW

2229 NACA-TN-3141

Lewis Flight Propulsion Lab., NACA

COMBINED NATURAL-AND FORCED-CONVECTION LAMINAR FLOW AND HEAT TRANSFER OF FLUIDS WITH AND WITHOUT HEAT SOURCES IN CHANNELS WITH LINEARLY VARYING WALL TEMPERATURES. Simon Ostrach. Apr. 1954. 74p.

The flow of fluids with and without heat sources and subject to body forces between two plane parallel surfaces which are oriented in the direction of the generating body force is analyzed under the condition that the temperature vary linearly along these surfaces. Solutions of this problem are obtained in terms of "universal" functions which are tabulated for simple application to specific cases. Representative velocity and temperature distributions from which detailed study of the heat transfer is made are then computed. It is found that under certain conditions the effects of aerodynamic or frictional heating can be appreci-

able. Asymptotic solutions (for large values of the Rayleigh number) which render the computations simple are also presented. Comparison of the results from the method given with those obtained elsewhere in an approximate manner for a special case simulating the natural-convection flow of fluids with heat sources in a completely enclosed region shows that the approximate method is sufficiently accurate for problems in which the modified Rayleigh number is less than 10^4. (NACA abstr.)

2230 AEC-tr-2066

HEAT TRANSFER AND PRESSURE DROP IN THE STARTING AREA OF AIR-PASSED SLOTS. (Wärmeübergang Und Druckabfall In Anlaufgebiet Von Luftdurchströmten Spalten). A. Raesfeld. Translated from Chem.-Ing.-Tech. 25, 249-52(1953). 17p.

Heat transfer and pressure drop were experimentally determined using electrically heatable plates in a slotted arrangement. Measurements were made with slot widths of 5, 7, and 10 mm and flow depths of 50 and 100 mm. The average heat-transfer coefficients and pressure loss are plotted as a function of air velocity in the slot. A study of the dimensions of the exchange areas required for transferring a certain quantity of heat revealed that the required area decreased with decreasing length-to-width ratio of the slot. (M.P.G.)

2231 AERE-Lib/Trans-477

PHYSICO-CHEMICAL HYDRODYNAMICS. V. G. Levich. Akademi i Nauk S.S.S.R., 1952. [A book review by] M. P. Volarovich. Translated by V. Beak from Uspekhi Fiz. Nauk 51, 155-8(1953). 4p.

2232

SOLVING CONDUCTIVE HEAT TRANSFER PROBLEMS WITH ELECTRICAL-ANALOGUE SHAPE FACTORS. Robert V. Andrews (Texas Engineering Experiment Station, College Station). Chem. Eng. Progr. 51, 67F-71F(1955) Feb

Problems of heat conduction in relatively complicated shapes are attacked by deducing shape factors for a number of geometric configurations. With this technique, the geometic terms in Fourier's conductive heat transfer equation are replaced by shape factors which provide a means for more convenient solution. It is shown that a simple electric analogue can readily determine shape factors for any 3-dimensional geometry, where one of the dimensions is unit length. (K.S.)

2233

INVESTIGATION OF THE COEFFICIENT OF RESISTANCE IN FLOW AT NEAR SONIC VELOCITIES. I AND II. A. F. Gandel'sman, A. A. Gukhman, N. V. Ilyukhin, and L. N. Naurits. Zhur. Tekh. Fiz. 24, 2221-49(1954) Dec. (In Russian)

2234

TYPES OF FLOW OF GAS-LIQUID MIXTURES AND STABILITY BOUNDARIES IN VERTICAL TUBES. B. K. Kozlov. Zhur. Tekh. Fiz. 24, 2285-8(1954) Dec. (In Russian)

2235

EFFECTS OF AGITATION ON GAS FLUIDIZATION OF SOLIDS. T. M. Reed, III, and M. R. Fenske (Pennsylvania State Univ., State College). Ind. Eng. Chem. 47, 275-82 (1955) Feb.

An investigation of the effects of mechanical agitation on the rate of heat transfer between air and surfaces in contact with fluidized beds of solids is described. From pressure drop measurements it is shown that the entire solids content of a small vessel, 11 × 4 inches in rectangular cross section, may be fluidized with the aid of oscillating stirrers immersed in the bed at air flow rates which, without agitation, are insufficient for the production of the fluidized state. Measurements of heat transfer rates between heated beds of solids and plane surfaces in contact with the beds demonstrate that the agitation improves such heat transfer coefficients as much as 1000%. By using metallic particles about 10 to 30 μ in diam. and superficial air velocity of 0.2 fps, values of 140 to 170 Btu/(hr)(ft^2)(°F) are obtained for the heat transfer coefficients between the bed of solids and a plane surface oscillating at an average velocity of about 1 fps. (auth)

2236

HEAT TRANSFER DESIGN CHARACTERISTICS. WATER SUSPENSIONS OF SOLIDS. Jerome J. Salamone and Morris Newman (New York Univ., N. Y.). Ind. Eng. Chem. 47, 283-8(1955) Feb.

A study of the heat transfer characteristics of non-Newtonian suspensions containing solid particles of high thermal conductivity is reported. A new equation based on dimensional analysis was developed to predict the film coefficient of heat transfer for pseudoplastic suspensions in turbulent flow inside pipes. The individual properties of the components of the suspension were correlated with the exception of viscosity and density, which were measured as bulk properties at the conditions of heat transfer. The effective thermal conductivity of slurries with particles of high thermal conductivity in suspension was found to be a function of the flow rate—decreasing with increasing rate of flow and reaching some limiting value at full turbulence. This limiting value was found to be approximately a linear function of the surface area of the suspended particles per cubic foot of suspension. (auth)

MATERIALS TESTING

2237 ACSIL/Liby-9

Admiralty Centre for Scientific Information and Liaison, London (England)

SELECT BIBLIOGRAPHY OF PUBLISHED REFERENCES TO ULTRASONIC NON-DESTRUCTIVE TESTING. H. L. R. Hinkley, comp. Feb. 1952. 39p.

2238 WADC-TR-53-184

Ontario Research Foundation [Canada]

FATIGUE PREDICTION BY MEANS OF THE CYCLOGRAPH. R. L. Cavanagh. Nov. 1953. 135p. Contract AF33(038)-19151. (AD-23657)

An h-f, nondestructive, magnetic test instrument, the cyclograph, was employed to indicate changes in magnetic and electrical properties of SAE 4340 steel samples under different heat-treated conditions. Examination of the changes at low field strength revealed whether the sample was overloaded or underloaded in fatigue. By application of low static loads in the same sense as the fatigue load, the extent of fatigue damage was approximated. The static bend test in combination with the fatigue tests appeared the most convenient test for determining fatigue damage. (auth)

2239

AN APPARATUS FOR THE MEASUREMENT OF DYNAMIC MECHANICAL PROPERTIES OF POLYMERS OVER A WIDE TEMPERATURE RANGE. D. W. Robinson (Imperial Chem-

ical Industries Ltd., Welwyn Garden City, Herts, England). J. Sci. Instr. 32, 2-6(1955) Jan.

An apparatus for the measurement of the dynamic mechanical properties of polymers from 20 to 600°K is described. Transverse resonance vibrations are excited in a reed of the polymer which is clamped at one end, the vibration amplitude of the free end being detected photo electrically and displayed on an oscilloscope. Higher overtone modes of vibration can be measured by suitable amplification of this signal, and the dynamic Young's modulus and internal friction (mechanical losses) are deduced from the resonant frequency and width of the resonance curve. Temperature control is achieved by an adiabatic vacuum technique whereby the specimen is brought to the desired temperature through a controlled heat transfer from either a refrigerant (liquid nitrogen or liquid hydrogen) or hot silicone oil and then thermally isolated in a vacuum at this particular temperature. (auth)

2240

A MACHINE FOR THE MEASUREMENT OF ROLLING FRICTION. J. Halling (Univ. of Liverpool, England). J. Sci. Instr. 32, 8-9(1955) Jan.

The paper describes a machine which has been developed for the measurement of the resistance to rolling under a range of applied loading. The machine is essentially a compact compression machine in which the rolling friction is determined by the principle of the inclined plane. It has a range of loading of 20 to 1000 lb with a sensitivity of $\pm\frac{1}{2}$ lb. A simple modification enables the machine to be used over a greater load range but with a reduction in sensitivity. The same principles could be adopted where it is desired to measure small displacing forces acting on a system under load. (auth)

RADIOGRAPHY

2241

THULIUM 170 FOR INDUSTRIAL RADIOGRAPHY. R. Halmshaw (Armament Research Establishment, Woolwich, London, England). Brit. J. Appl. Phys. 6, 8-10(1955) Jan.

The use of Tm^{170} for industrial radiography has been investigated. The exact nature of the γ-ray spectrum does not appear to be agreed upon, and the absorption curves which have been obtained suggest the presence of some high-energy radiation, probably due to bremsstrahlung. Exposure curves for steel and Al are given, and a sensitivity curve for step penetrameters is derived. The values calculated are compared with experimental values using step and wire penetrameters and with radiographs taken with Ir^{192} and x rays. The suitability of intensifying screens is discussed and some possible applications of Tm^{170}, taking into account the low activity of present sources, are suggested. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

2242 NP-5508

Department of Mines and Technical Surveys. Mines Branch (Canada)

ELECTRONIC CONCENTRATION OF LOW GRADE ORES WITH LAPOINTE PICKER. A. H. Bettens and Christian Lapointe. Nov. 23, 1954. 19p. (TR-123/54)

Constructional details are given of a new electronic picker unit for the concentration of coarse low-grade uranium ore using a scintialltion detector. Typical results obtained with low-grade ore from two mines in the Beaverlodge area are presented as examples of the concentration achieved with the higher sensitivity of such a detector. Comparative tests with a Geiger detector are also reported. (auth)

2243

ANALYSIS OF CONTINUITY OF ONE PHASE IN A POWDER MIXTURE OF TWO PHASES. F. Forscher (Westinghouse Electric Corp., Pittsburgh, Penna.). J. Franklin Inst. 259, 107-14(1955) Feb.

The paper contains a theoretical analysis of the continuity of one phase (powder A) in a mixture of two powders (A and B). It is assumed that the two powders are well mixed so that particles of powder A are randomly distributed in powder B. The continuity condition for powder A is expressed by the probability that the separation between two particles of this phase vanishes. For spherical particles of unequal sizes the continuity condition can be stated as the probability that the distance between the centers of any two particles of powder A equals the sum of their radii. General equations are developed, and a powder mixture of equal spherical particles is discussed as a special case. (auth)

2244

THE FRIABILITY TEST AS A METHOD OF EVALUATING SINTER CAKE. I. Sheinhartz and H. M. McCullough (Sylvania Electric Products Inc., Bayside, N. Y.). Powder Met. Bull. 7, 22-4(1954) Dec.

Chemical impurities and other inclusions that may be present in a sinter cake can be detected by the friability test. This makes it possible to rework or scrap the material before subsequent processing operations are performed. (auth)

2245

RARE METALS HANDBOOK. Clifford A. Hampel, ed. New York, Reinhold Publishing Corporation, 1954. 657p.

The available reference data are presented on latest methods of production, chemical and physical properties, fabrication, and present and potential uses for over 34 rare or uncommon metals. The treatment is limited to emphasis on the metallic or elemental form with only a minor presentation of material about compounds. The designation "Rare Metals" was chosen because of its long use in symposia of the Electrochemical Society, and is felt to be simpler and less misleading than other names, e.g., "Less Common Metals", "Unusual Metals", or "Extraordinary Metals" that might have been chosen. (L.M.T.)

CERAMICS AND REFRACTORIES

2246 NRL-4447

Naval Research Lab.

A METALLURGICAL EVALUATION OF REFRACTORY COMPOUNDS FOR CONTAINING MOLTEN TITANIUM. PART I. OXIDES. E. J. Chapin and W. H. Friske. Nov. 18, 1954. 42p.

A metallurgical study was conducted on the suitability of selected refractory oxides as crucible materials for molten titanium. Melting experiments were conducted in a manner to observe effects on the crucible and on metal quality. Alumina, beryllia, stabilized zirconia, and thoria

were investigated in the form of crucibles, while gadolinia was evaluated by direct arc fusion with titanium. All of the oxides were attacked in varying degree of severity by molten titanium. The metal was contaminated by reaction products resulting in increased hardness and in the development of extreme brittleness in certain cases. (auth)

2247 NRL-4467
Naval Research Lab.
A METALLURGICAL EVALUATION OF REFRACTORY COMPOUNDS FOR CONTAINING MOLTEN TITANIUM. PART II. CARBON, GRAPHITE, AND CARBIDES. E. J. Chapin and W. H. Friske. Dec. 15, 1954. 25p.

Crucibles of high-purity carbon with exceptionally smooth dense surfaces and of commerically pure and spectroscopically pure graphite were investigated to determine if purity and surface finish were beneficial factors. The results were negative. The monocarbides of Ti, Zr, V, Nb, Ta, and W were investigated for their suitability as crucible materials for melting titanium. All the carbides were attacked by molten titanium resulting in general solution of the crucible and contamination of the melt, principally with carbon. TiC was found to be the main carbide phase occurring in the metal, derived from reduction of the crucible carbide by molten titanium at the liquid-solid interface. The carbides are not considered suitable crucible materials. (For preceding report in series see NRL-4447.) (auth)

2248 NRL-4478
Naval Research Lab.
A METALLURGICAL EVALUATION OF REFRACTORY COMPOUNDS FOR CONTAINING MOLTEN TITANIUM. PART III. BORIDES AND SULFIDES. E. J. Chapin and W. H. Friske. Jan. 17, 1955. 34p.

Diborides of Ti, Zr, and Cr in crucible form were investigated for melting titanium. In all cases the molten titanium reacted with the crucible at the interface to produce general solution attack and to cause severe contamination of the metal with brittle boron compounds. Solution of the reaction products resulted in an increase in melting point, making pouring difficult. These borides are not considered promising as crucible materials. CeS was also investigated in crucible form. General solution attack of the crucible occurred with contamination of the titanium melt. Metallographic and chemical analytical evidence indicates a binary eutectic system between Ti and CeS. In spite of the appreciable contamination with sulfur the hardness level was increased only moderately. Further investigation is required to determine if larger crucibles would be beneficial in minimizing sulfur pickup by the molten metal. (For preceding report in series see NRL-4467.) (auth)

2249
CERAMIC COATINGS FOR NUCLEAR REACTORS. A PROGRESS REPORT. Joseph C. Richmond, Henry G. Lefort, Charles N. Williams, and William N. Harrison (National Bureau of Standards, Washington, D. C.). J. Am. Ceram. Soc. 38, 72-80(1955) Feb.

Ceramic coatings were prepared from materials having low absorption coefficients for thermal neutrons. They were specifically designed for application to typical high-temperature alloy parts for use in nuclear reactors. Best results were obtained with boron-free coatings of the frit-refractory type, in which a high-barium frit containing small amounts of phosphate, beryllia, lime, zinc oxide, and titania was milled with additions of ceria or mixtures of chromic oxide and ceria. Coating compositions and test data are given. (auth)

2250
SINTERING OF REFRACTORY POWDERS. Paul Schwarzkopf (American Electro Metal Corp., Yonkers, N. Y.). Bull Am. Cerem. Soc. 34, 45-7(1955) Feb.

The theories of metallic sintering appear applicable to the sintering of pure refractory hard metals (carbides, nitrides, borides, and silicides). It should be realized, however, that the atomic mechanism of the material transport involved in sintering of pure hard metal phases is not fully understood. Most of the recently developed hard metal-base refractories are cemented, that is, metal-bonded materials. In these systems, sintering takes place in the presence of a liquid phase which in most cases is represented by a eutectic composition. The mechanism of eutectic sintering is in many aspects better understood than that of sintering in the absence of a liquid phase. The meaning of perfect wetting is discussed, and a mechanism is suggested for the information and subsequent disruption of a skeleton during liquid-phase sintering. (auth)

CORROSION

2251 AECU-2992
Institute for the Study of Rate Processes, Univ. of Utah.
THE KINETICS OF THE CORROSION OF COPPER IN ACID SOLUTIONS. John Randel Weeks and George Richard Hill. Dec. 15, 1954. 21p. Contract AT(11-1)-82, Technical Report No. 17.

The corrosion mechanism of copper in dilute hydrochloric acid solutions was investigated, and data are presented on the effects of time, pH, concentration of dissolved O_2, and temperature on the corrosion mechanism. (C.H.)

2252 MET.I.-3
Chalk River Project (Canada)
EFFECTS OF COLD WORKING ON CORROSION OF HIGH PURITY ALUMINUM IN WATER AT HIGH TEMPERATURES. M. J. Lavigne. Nov. 4, 1954. 18p.

The effects of cold working and cold-working and annealing to complete recrystallization on the corrosion resistance of high-purity Aluminum in water at 100, 150, and 200°C have been determined. In distilled water at 100°C, high-purity Aluminum cold worked 5 to 50% inclusive and all the recrystallized aluminums corrode intergranularly, but materials cold worked 60% and over are immune against this attack. At 150 and 200°C, the 60 and 70% cold-worked materials corrode intergranularly while the 80 and 90% cold-worked corrode generally. The attack on the latter materials appears to be also selective as some grains corrode preferentially to others. (auth)

2253
LEAD REFERENCE SHEET. PART 2. Kempton H. Roll (Lead Industries Association, New York). Chem. Eng. Progr. 51, 104F(1955) Feb.

The corrosion characteristics of Pb to a large number of acids, alkalies, their salts, gases, and organic materials are tabulated. These corrosion resistance characteristics are reviewed in relation to the application of Pb to a group of industrial processes. (K.S.)

2254
CORROSION. Mars G. Fontana. Ind. Eng. Chem. 47, 81A-2A(1955) Feb.

A nomograph is shown for rapid and ready conversion of corrosion rates into mils per year, inches per month, and milligrams per square decimeter per day. The cost of metals and alloys is discussed, and ratings of various materials are tabulated according to low, medium, high, and very high cost. (J.A.G.)

2255

CORROSION AND EROSION-CORROSION OF SOME METALS AND ALLOYS BY STRONG NITRIC ACID. J. F. Willging (Sinclair Research Labs., Harvey, Ill.), J. P. Hirth (Wright-Patterson Air Force Base, Ohio), and F. H. Beck and M. G. Fontana (Ohio State Univ., Columbus). Corrosion 11, No. 2, 31-9(1955) Feb.

The corrosion and erosion-corrosion resistance of several stainless steels and aluminum alloys in strong nitric acid in the temperature range of room temperature to 160°F were investigated. In general the stainless steels shows a marked increase in corrosion with increasing temperature. Galvanic couple systems of aluminum and stainless steel show the stainless steel to be protected by the aluminum which acts as a sacrificial anode in strong nitric acid. Polarization studies on aluminum and stainless steel provide some interesting information concerning the corrosion behavior of the aluminum–stainless steel couple system. Erosion-corrosion tests show that the rate of attack on stainless steel decreases with increasing velocity of acid flow; the rate of attack on aluminum tends to increase with increasing velocity of acid flow. Experiments were conducted on both rotating specimens and on stationary specimens in a system involving a flowing solution. A detailed description of the equipment used for the polarization and the erosion-corrosion studies is included. (auth)

2256

SOME REMARKS ON STRESS CORROSION TESTING. Hugh P. Godard and J. J. Harwood. Corrosion 11, No. 2, 53-8 (1955) Feb.

Some of the theories relating to the influence of stress in accelerating corrosion are reviewed briefly. A warning is given not to make assumptions on the resistance to stress corrosion of a material solely on the basis of a timed test because of the cumulative nature of the phenomenon. The merits and uses of several kinds of stress corrosion tests are explained and some of the factors to be considered in evaluating results enumerated. Influence of the environment, metal structure, specimen orientation, surface area and finish are considered. The several means of applying stress to specimens, the devices used to apply the stresses and some of the merits and demerits of various testing devices are considered. 33 references. (auth)

2257

RADIOACTIVE TRACERS IN THE STUDY OF PITTING CORROSION ON ALUMINUM. P. M. Aziz (Univ. of Chicago, Ill.). J. Electrochem. Soc. 101, 120-3(1954) Mar.

Radioactive cobalt and lead ions in solution have been used to study the distribution of local cathodes on aluminum alloy specimens which were actively pitting, and to study the processes of film breakdown and repair on aluminum alloy specimens after introducing them into a corrosive environment. In the study of pitting, radioactive ions were introduced into the solution after pitting of the sample had proceeded for a predetermined length of time. The tracer was then permitted to plate out onto local cathodes, and, after washing and drying, autoradiographs of the surface were prepared. Results indicate that after a pit is a few hours old it is surrounded by a ring of cathodic surface and outside this is an annular ring of passive surface which prevents lateral expansion of the corrosive attack, the remainder of the surface being cathodic. In the study of the mechanism of film breakdown and repair, samples with different surface treatments were placed in the solution and radioactive ions were introduced after various predetermined times, exchange permitted to take place, samples washed and dried, and autoradiographs prepared of the surface. Results indicate that, on contact with the solution, the surface oxide film breaks down and is then repaired by reaction with the solution. (auth)

2258

THE PROTECTIVE ACTION OF PIGMENTS ON STEEL. M. J. Pryor (Kaiser Aluminum and Chemical Corp., Spokane, Wash.). J. Electrochem. Soc. 101, 141-8(1954) Mar.

The action of aqueous extracts from litharge, metallic lead, red lead, basic lead carbonate, zinc, and zinc oxide on the corrosion of steel was investigated. It was found that litharge extracts inhibited the corrosion of steel completely, that extracts from metallic lead and red lead inhibited for a short period, and that extracts from basic lead carbonate, zinc, and zinc oxide lead had no protective action. Protective properties of the decanted extracts were in the same order as their reserve alkalinities. Litharge, metallic lead, and red lead extracts protected only when they contained dissolved air; when deaerated, they attacked steel slowly. The passivity film formed in litharge extracts was found to be composed largely of γ-Fe_2O_3, no lead compounds being detected. It was considered that the lead in the litharge extracts was present partly in the ionic form, possibly as $Pb(OH)^+$ ions, whereas the lead in extracts from metallic lead was present mainly as massive and colloidal lead hydroxide. (auth)

2259

POLARIZATION STUDIES OF COPPER, NICKEL, TITANIUM, AND SOME COPPER AND NICKEL ALLOYS IN THREE-PER CENT SODIUM CHLORIDE. H. B. Bomberger (Rem-Cru Titanium, Inc., Midland, Penna.), F. H. Beck and M. G. Fontana (Ohio State Univ., Columbus). J. Electrochem. Soc. 102, 53-8(1955) Feb.

Polarization characteristics were determined for some metals and alloys in flowing salt solutions. Relationships between potential and time, potential and applied current, applied current and corrosion rate, and solution velocity and corrosion rate were considered. Copper and brass anodes dissolved readily. Nickel and copper-nickel alloys exhibited anodic polarization. Titanium anodes resisted dissolution by film growth and extensive polarization. (auth)

GEOLOGY AND MINERALOGY

2260 GPR-4/54

Department of Mines and Technical Surveys. Mines Branch (Canada)

RADIOACTIVITY DIVISION GENERAL PROGRESS REPORT [FOR] OCTOBER–DECEMBER 1954. Jan. 17, 1955. 22p.

Status of the work on ore dressing and extractive mineralogy and a listing of chemical and radiometric assays of ores during the period and associated activities is presented. No technical data are reported. (For preceding period see GPR-2/54.) (J.E.D.)

2261 NP-5509

Department of Mines and Technical Surveys. Mines Branch (Canada)

A STUDY OF THE CONTACT TIME IN PILOT PLANT AGITATORS USING A RADIOACTIVE TRACER. J. C. Turgeon. Nov. 29, 1954. 8p. (TR-124/54)

A sample of $Eu^{152-154}$ was introduced into the first agitator of a pilot leach plant and its course through the other three agitators followed to determine the rate at which material moves through the leaching circuit. Peaks in the activity versus time curves for the second, third, and fourth agitators occurred 12, 24, and 36 hr, respectively, after the introduction of the tracer, indicating that the average contact time was 12 hr. The activity in No. 1 agitator decreased exponentially with time and fell to 1/e of its original value in 14 hr. (auth)

2262 RME-3102

Utah Univ.

SOME STRATIGRAPHIC, SEDIMENTARY, AND STRUCTURAL RELATIONS OF URANIUM DEPOSITS IN THE SALT WASH SANDSTONE. FINAL REPORT [FOR] APRIL 1, 1952 TO JUNE 30, 1954. William Lee Stokes. Sept. 1954. 50p. Contract AT(30-1)-1182.

Field and laboratory investigations of the uranium deposits in the Salt Wash sandstone of the Colorado Plateau were carried on. Chief aims of the project were to determine why certain areas are well mineralized while others are barren and to discover possible geologic guides to hidden ore deposits. The following general problems were investigated: nature and origin of primary structures and their use in tracing zones that are favorable or unfavorable to mineralization; relation of sedimentary properties of Salt Wash sandstones to primary structures and ore formation; occurrence and meaning of the repetition of rock types in the Salt Wash; relation of fossil plants or other organic material to sedimentary patterns and ore; and relation of sedimentary patterns to mineralized areas and to ancient structural features such as buried faults. Although none of these problems can be considered solved, it is concluded that the Salt Wash displays a variety of primary structures that can be mapped to give information on sedimentary patterns and on the possible continuity and trend of favorable and unfavorable zones or belts. Accumulated evidence also indicates that clues leading to the finding of deposits of fossil organic material are important in locating ore. Such favorable sites are thought to be mainly old river bends which are now shown by curving patterns of sediments. The areas of pronounced bends and diversity of sediments with greater than average amount of carbonaceous material are though to occur in places where normal directions of flow were broken up or deflections of current took place due to tectonic features such as salt domes or buried faults. At these places a favorable environment to the formation of uranium minerals was created after burial and partial lithification of the sediments. Although these facts and inferences may be useful in explaining the localization of mineralized districts, they do not give the geologic date of ore formation. Development and application of theories and techniques was centered in six separate mineralized areas: King Tut Mesa and vicinity, Carrizo Mountains district; Northwest Carrizo area; Cove Mesa and vicinity, Carrizo district; Lukachukai Mountains; Blanding mines area; and San Rafael River area. Findings in these districts are briefly summarized. (auth)

2263 TEM-341A

Geological Survey

SUMMARY OF URANIUM-BEARING COAL, LIGNITE, AND CARBONACEOUS SHALE INVESTIGATIONS IN THE ROCKY MOUNTAIN REGION DURING 1951. N. M. Denson. With DESCRIPTION OF DEPOSITS. G. O. Bachman, J. R. Gill, W. J. Hail, Jr., J. D. Love, Harold Masursky, N. M. Denson, G. W. Moore, G. N. Pipiringos, J. D. Vine, and H. D. Zeller. May 1952. 44p.

Six areas in the western United States containing uraniferous coal, lignite, and carbonaceous shale have been examined in some detail to outline the potential uranium resources and mode of occurrence of uranium-bearing carbonaceous sediments. The potential resources in the areas examined range from 350,000,000 tons of coal containing 20,000 tons of uranium in the Red Desert area of Wyoming to 200,000 tons of lignite containing 20 tons of uranium in the Lodgepole area of South Dakota. An epigenetic hypothesis of origin of the deposits is proposed based on a considerable but as yet incomplete body of field and laboratory data. Leaching of overlying volcanic rocks contributes uranium to the ground-water. The uranium may be deposited immediately subjacently or moved considerable distances laterally or vertically before encountering favorable depositional conditions by adsorption on phosphatic, carbonaceous, or clayey beds. The distribution of the radioactive materials in the "receptor" beds with respect to permeability zones strongly favors this hypothesis. (auth)

2264

ORE VIA CHROMATOGRAPHY. Ind. Eng. Chem., 47, 13A-14A(1955) Feb.

A paper chromatographic procedure for the detection of trace metals for use in geochemical ore prospecting is presented. The metals are dissolved and chromatographically separated on sheets of filter paper. The amount of trace metal detected on each strip of paper will be of the order of 0.05 to 10 mg. Concentration of the trace metal in the soil (expressed as parts per million) can be calculated from the amount of soil taken, the volume of the extract, and the fraction of the extract applied to the strips. The accuracy of the method is of the order of 30%. Chromatographic methods have been worked out for Cu, Co, and Ni; Nb and Ta; and Pb and U. (J.A.G.)

2265

RADIOACTIVITY IN GEOLOGY AND COSMOLOGY. Truman P. Kohman and Nobufusa Saito (Carnegie Inst. of Tech., Pittsburgh, Penna.). Ann. Rev. Nuclear Sci. 4, 401-62(1954)

The geological and cosmological ramifications of radioactivity in nature are surveyed by a review and interpretation of material published from 1951 to 1954. The examination of 592 references provides a basis of broad discussion on the natural occurrence of radionuclides, radioactivity and the measurement of geologic time, the nature of radiogenic terrestrial heat, and the relationship between radioactivity and cosmic history. (K.S.)

2266

GEOLOGICAL STUDIES OF URANIUM-VANADIUM DEPOSITS BY GEOPHYSICAL EXPLORATION METHODS. Sherwin F. Kelly. Precambrian 26, No. 6, 21-9(1953) June.

2267

ISOTOPIC COMPOSITION OF WATER OF CRYSTALLIZATION. R. V. Teis (Vernadskii Inst. Geochemistry and

Analytical Chemistry). Doklady Akad. Nauk S.S.S.R. 99, 585–8(1954) Dec. 1. (In Russian)

Distribution of O^{18} between $Na_2SO_4 \cdot 10H_2O$-, $CaSO_4 \cdot 2H_2O$, $BaCl_2 \cdot 2H_2O$, and $Na_2CO_3 \cdot 10H_2O$ and their mother liquors has been studied at various temperatures of crystallization with a view toward application to paleothermometry. (G.Y.)

2268

AIRBORNE RADIOACTIVITY SURVEY OF THE PRINTED DESERT AREA, COCONINO AND NAVAJO COUNTIES, ARIZONA. GEOPHYSICAL INVESTIGATIONS MAP GP 120. J. L. Meuschke. Washington, U. S. Geological Survey, 1955. $0.50

2269

PHOTOGEOLOGIC MAP OF THE CARLISLE-13 QUADRANGLE, SAN JUAN AND GARFIELD COUNTIES, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-2. J. N. Platt. Washington, U. S. Geological Survey, 1954. $0.50.

2270

PHOTOGEOLOGIC MAP OF THE DESERT LAKES-8 QUADRANGLE, SAN JUAN AND GARFIELD COUNTIES, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-4. P. P. Orkild. Washington, U. S. Geological Survey, 1954. $0.50

2271

PRELIMINARY GEOLOGIC MAP SHOWING THE DISTRIBUTION OF URANIUM DEPOSITS AND PRINCIPAL ORE-BEARING FORMATIONS OF THE COLORADO PLATEAU REGION. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 16. W. I. Finch. Washington, U. S. Geological Survey, 1955. $0.50

2272

BIBLIOGRAPHY OF U. S. GEOLOGICAL SURVEY TRACE ELEMENTS AND RELATED REPORTS TO JUNE 1, 1954. Jane H. Wallace and Harriet B. Smith. U. S. Geol. Survey Bull. 1019-B, 63-144(1955). $0.30 (GPO).

A list of reports is compiled as a reference guide to Geological Survey reports on radioactive raw materials. The articles, together with index numbers, are listed by typed of publication or release. (J.E.D.)

METALS AND METALLURGY

2273 AD-26044

Allegheny Ludlum Steel Corp.

CAST NICKEL-BASE HEAT-RESISTING ALLOYS. FINAL REPORT. R. S. DeFries, E. E. Reynolds, and W. W. Dyrkacz. Oct. 15, 1953. 50p. Contract NOa(s) 52-216-c.

A study was made of cast Ni-base alloys with (1) Cr, Mo, Al, and Fe, (2) Mo and Al, and (3) Cr and/or Mo. Room-temperature tensile tests, stress-rupture tests at 1500 and 1600°F, and microstructural studies were used as criteria of evaluation. Alloys of the type reported by Guy (Trans. Am. Soc. Metals 41, 125(1949)), which contained Cr, Mo, Al, and Fe, were superior in rupture properties to those with Mo and Al; both were superior to those with Cr and/or Mo. The strategic metal Cb, 2% of which was present in the Guy-type alloy, could be eliminated by the use of 0.05 to 0.20% B rather than the 0.5% B present in the parent alloy. At the 0.5% B level, V was a satisfactory replacement for Cb. A C level of about 0.15% improved rupture ductility over that obtained at the 0.05% level, but decreased room-temperature ductility. Lowering of Al content in the Guy-type alloy improved rupture properties. The ductility of the Ni-base alloys tended to decrease as strength increased. Melting practice variables, particularly deoxidation and pouring temperature, were important factors in the strength of the alloys, which could be virgin-melted and remelted by both induction and indirect arc methods. (ASTIA Abst.)

2274 AD-26731

Battelle Memorial Inst.

INVESTIGATION OF MOLYBDENUM AND MOLYBDENUM-BASE ALLOYS MADE BY POWDER-METALLURGY TECHNIQUES. SUMMARY REPORT FOR THE PERIOD JUNE 1, 1951 TO JUNE 30, 1953. W. L. Bruckart C. M. Craighead, and R[obert] L. Jaffee. June 30, 1953. 225p. Contract AF33(038)-12641.

A study was made of Mo binary alloys containing Cb, Ta, Ti, and Zr. These additions results in some strengthening for all 4 groups, but at the expense of ductility. The Mo–Ti alloys were very poor in strength and ductility. The Mo–1% Zr was the strongest, with an ultimate tensile strength of 110,000 psi and an 8% elongation. Study indicated ternary alloying to be less effective percentage-wise than binary alloying, since the changes in properties were less than additive. However, superior properties were obtained with ternary alloys since they could be fabricated with a greater total alloying concentration than was present in the corresponding fabricable binary alloys. Ternary Mo alloys containing 0.1% B showed no outstanding properties. Screening creep-rupture studies were conducted at 1800°F and at a stress of 25,000 psi. Initially, the outstanding alloy was an Ni–clad Mo–0.2% Si alloy which lasted 293 hr. Room-temperature rotating-beam fatigue tests were conducted with wrought Mo from Climax (arc-cast type) and Fansteel (powder-metallurgy type). Endurance ratios of 0.66 to 0.81 were obtained for 2 lots of the former type at 50×10^6c. The endurance ratios for the latter type were 0.70 and 0.74. (ASTIA Abst.)

2275 AD-33840

Engineering Research Inst., Univ. of Mich.

INTERMEDIATE TEMPERATURE CREEP AND RUPTURE BEHAVIOR OF TITANIUM AND TITANIUM ALLOYS. QUARTERLY PROGRESS REPORT NO. 6 [FOR] JANUARY 15, 1954 TO APRIL 14, 1954. J[eremy] V. Gluck and J[ames] W. Freeman. 16p. Contract AF33(616)-244.

Progress is reported on a metallographic investigation of a 10% Mo alloy, and proposed test conditions are discussed. In addition, total deformation studies on the as-forged conditions of 6% Al and 30% Mo alloys at 600 and 1000°F are reported. Tensile and rupture test data at 800°F are discussed for hot-worked conditions of Ti150A. Results of tensile tests at room temperature for Ti75A, Ti150A, 6% Al, and 30% Mo alloys after creep testing at 600 to 1000°F are presented. (J.A.G.)

2276 AD-40272

Battelle Memorial Inst.

THE EXTRUSION OF TITANIUM. PHASE REPORT [FOR] AUGUST 1, 1953 TO JUNE 30, 1954. A. M. Sabroff, W. M. Parris, and P. D. Frost. Battelle Memorial Inst. and [Metal Trims, Inc.]. [Aug. 25, 1954]. 37p. Contracts [AF33(600)-3736 and AF33(600)-9203].

Extrusion-temperature studies were conducted in which four unalloyed titanium billets were extruded at 1450, 1600, 1750, and 1900°F, and five billets of the Ti–3Mn–1Cr–1Fe–1Mo–IV alloy were extruded at 1350, 1450,

1525, 1600, and 1700°F. All of the billets were extruded through flat-faced dies to bars, using a 21 to 1 extrusion ratio. A graphite-base lubricant was used in all of these tests. The unalloyed bars extruded in the alpha-phase region (1450 and 1600°F) exhibited higher yield and ultimate strengths than the bars extruded in the beta-phase region (1750 and 1900°F), the average ultimate strengths being 85,000 and 70,000 psi, respectively. At 1450 and 1600°F, the bars were only partially recrystallized, whereas the bars extruded in the beta-phase region had completely recrystallized by transformation to alpha on cooling. Annealing for 1 hour at 1500°F and air cooling did not produce any significant change either in tensile properties or microstructure. In the as-extruded condition, specimens of the Ti—3Mn complex bars extruded at 1525°F or higher exhibited brittle fractures. At the lower extrusion temperatures of 1350 and 1450°F, however, this alloy exhibited good combinations of strength and ductility—183,000 to 200,000-psi ultimate strength and 10.5 to 3.5 per cent elongation in 2 inches. Solutions treating at 1300°F, followed by overaging at 800, 900, and 1100°F for various lengths of time, produced strength levels of 180,000, 170,000, and 130,000 psi, respectively. The ductility at these strength levels, however, decreased as the extrusion temperature increased. In each of the conditions tested, the optimum combination of strength and ductility was obtained at an extrusion temperature of 1350°F. In all of the tests with flat-faced dies, the surface condition on the back portion of the extruded bars was poor. Examination of the billet skulls indicated that a stagnant metal zone existed at the die shoulder during extrusion. As a result, the lubricant became ineffective and poor surfaces were obtained. In the evaluation studies on conical dies, four billets of unalloyed titanium were extruded at 1600°F to 1-in.-diam. bars through dies having included angles of 180 (flat faced), 160, 140, and 120 degrees. The stagnant metal zone decreased in size as the included angle decreased, and it was completely eliminated with the 120-degree die. The best surface, however, was produced with the 140-degree die, which caused only a slight stagnant zone on the lower half of the billet. In addition, the 140-degree die required the minimum extrusion pressure, whereas the 120-degree die required the maximum pressure. These tests indicated that the optimum die angle, with regard to metal flow, surface finish, and extrusion pressure, lies between 120 and 140 degrees. (auth)

2277 AD-40736

Metallurgical Labs., Dow Chemical Co.

ATOMIZED MAGNESIUM POWDER. PART I. STUDIES ON THE ATOMIZING OF MAGNESIUM. PART II. CLASSIFICATION, PARTICLE SIZE MEASUREMENT, AND EXPLOSIBILITY OF MAGNESIUM POWDER. FINAL REPORT. [Apr. 14, 1953]. 40p. Contract DA-20-018-ORD-6029.

Methods and equipment for the wheel atomizing of Mg on a production scale have been developed. Powder can be produced with a controlled average diameter of 75 to 400 ± 50μ for the larger particles. The estimated lower limit of particle size is 40 to 50μ. The bearingless turbine has been developed into a dependable piece of production equipment with a speed limited only by the bursting strength of the rotor and wheel materials. Wheel attack by Mg can be eliminated by alloying the Mg with 1% Zn and 0.1% Zr. The air permeability method of particle size measurement was found to have an accuracy of ± 4% and to be a satisfactory fast method for certification and control of particle size during production. Explosibility of Mg powder was investigated, and all Mg dust formations should be considered hazardous. (M.P.G.)

2278 AD-40737

Metallurgical Labs., Dow Chemical Co.

ATOMIZED MAGNESIUM POWDER. PART II. DESCRIPTION OF MANUFACTURE. FINAL REPORT. [Dec. 1, 1953]. 33p. Contract DA-20-018-ORD-6029.

2279 AD-43232

Engineering Research Inst., Univ. of Mich.

INTERMEDIATE TEMPERATURE CREEP AND RUPTURE BEHAVIOR OF TITANIUM AND TITANIUM ALLOYS. QUARTERLY PROGRESS REPORT NO. 7 [FOR] APRIL 15, 1954 TO JULY 14, 1954. J[eremy V. Gluck and J[ames] W. Freeman. July 14, 1954. 32p. Contract AF33(616)-244.

The effects of creep testing at 800°F and 35,000 psi and 600°F and 83,000 psi on the room-temperature tensile properties of Ti 150A heat treated for 1 hr at 1500°F and air-cooled and 1 hr at 1350°F and furnace cooled are reported. The data show that severe embrittlement occurred in 1500°F air-cooled material within 20 hr at 800°F. The 1350°F air-cooled samples failed within the gage section and a significant reduction in ductility was noted within 50-hr exposure at 600°F. Survey tests of tensile and creep-rupture properties were run at 600, 800, and 1000°F on Ti 150A heat treated for 1 hr at 1500°F plus furnace and air cooling and at 1800°F plus isothermal transformation for 1 hr at 1300°F plus water quenching, and the results are compared with previously reported tests and tabulated. The effects of hot working on Ti 150A at 800°F are discussed. Tensile and creep-rupture tests were run on samples given three different one-pass reductions at 1200, 1350, 1500, or 1650°F, and results are tabulated. No marked changes in properties were obtained by working the material in the α-β region over those obtained by merely heat treating in this region. Tentative total deformation and rupture relationships on as-forged 30% Mo and 6% Al alloys are presented. Metallographic studies and tensile tests were carried out on the Ti 75A, Ti 155 AX, 6% Al—0.5% Si, and 10% Cr alloys. (For preceding period see AD-33840.) (J.A.G.)

2280 EES-9C(4)966861

Naval Engineering Experiment Station, Annapolis

BASIC INFORMATION ON THE BEARING PROPERTIES OF VARIOUS MATERIALS IN LIQUID METALS. M. R. Gross and W. J. Greenert. [Includes appendix: CALCULATION OF STRESSES IN CONTACT ROLLER TEST. Watt V. Smith]. Nov. 20, 1952. 63p.

Bearing properties of various materials exposed to a liquid metal environment are presented. Results on the rolling contact behavior of SAE 52100 steel under various conditions of viscosity and temperature are discussed. These variations were accomplished by substituting hydrocarbons for the liquid metal environment. The data indicate that viscosity and temperature are critical factors influencing the load carrying capacity of SAE 52100 in liquid metal. It is concluded that the inherent difference in load carrying capacity between materials of similar composition and structure are intensified by reduced viscosity and/or increased temperature of the test environment. Also, standard antifriction bearings were found to be sensitive to dissolved atmospheric gases in low viscosity hydrocarbons. In addition to a discussion of the

mechanism of failure, the report contains a appendix describing the method of stress calculation. (auth)

2281 JPL-PR-20-212
Jet Propulsion Lab., Calif. Inst. of Tech.
A CONSTITUTION DIAGRAM FOR THE ALLOY SYSTEM TITANIUM—TIN. PROGRESS REPORT. Paul Pietrokowsky and Ellis P. Frink. Mar. 22, 1954. 34p. Contract DA-04-495-Ord-18. (AD-40935)

Metallographic, x-ray, incipient-melting, and thermal-analysis methods were used to investigate the binary constitution diagram titanium—tin. The titanium-rich portion of the phase diagram is characterized by eutectic and eutectoid reactions. Substantial quantities of tin are soluble in both allotropic forms of titanium. Two intermediate phases, Ti_3Sn and Ti_6Sn_5, are formed directly from the melt, whereas Ti_2Sn and Ti_5Sn_3 have hidden maxima, Ti_2Sn is the only intermediate phase observed to exist over an appreciable composition range. There are extensive regions of Ti_6Sn_5 plus liquid and Ti_6Sn_5 plus tin which are separated by a temperature horizontal at 232°C. The solubility of titanium in tin is slight. The crystal structure of Ti_2Sn is isomorphous with the filled B8 type. (auth)

2282 NP-5501
Massachusetts Inst. of Tech.
RESEARCH ON CREEP STRUCTURE CHARACTERISTICS OF TITANIUM AND ITS ALLOYS. FINAL REPORT. [THE HIGH TEMPERATURE BEHAVIOR OF TITANIUM AND SOME OF ITS ALLOYS]. Lee S. Richardson, John Lunsford, and Nicholas J. Grant. [1954?]. 24p. Contract DA-19-020-ORD-2787.

The strength of titanium and its alloys decrease sharply with temperature from 1000 to 1600°F. Solid-solution alloying increases the high-temperature strength of titanium significantly, 5.9% Al increasing the stress for a given rupture life by a factor of 5. The pick-up of O during test increases the strength of Ti markedly, but makes the material considerably more brittle. This pick-up becomes especially important at temperatures of 1400°F and above. Because of this, testing of Ti at temperatures of 1400°F and higher must be done under very closely controlled conditions to avoid increases in strength far larger than the increase due to a nominal alloy addition. This oxidation phenomena presents a serious limitation to the use of titanium at these relatively high temperatures. (auth)

2283 NP-5507
Metallurgical Advisory Committee on Titanium
SUMMARY OF SYMPOSIUM ON SURFACE TREATMENT OF TITANIUM, SPONSORED BY WATERTOWN ARSENAL LABORATORY AND HELD AT ARMOUR RESEARCH FOUNDATION, CHICAGO, ILLINOIS, ON JANUARY 28, 1953. 16p.

The symposium was devoted to coatings for oxidation protection including electroplating, surface hardening, carburizing and induction heating, nitriding, vapor deposited coatings, chemical surface treatments, and wear and friction phenomena. (J.E.D.)

2284 NP-5510
Metallurgical Advisory Committee on Titanium
MINUTES OF TITANIUM SYMPOSIUM ON DIFFUSION AND MECHANICAL BEHAVIOR. [SPONSORED BY WATERTOWN ARSENAL LABORATORY AND] HELD AT COLUMBIA UNIVERSITY JUNE 9 AND 10, 1954. 58p.

Summaries are given of papers presented during this conference. Topics discussed include the diffusion rates of C, H, N, O, and Zr in Ti; self-diffusion of Ti; effect of H on the ultrasonic attenuation in Ti; effects of temperature on slip and twinning in Ti; plasticity of β Ti; effects of microsturcture on mechanical properties of Ti alloys; effects of temperature and load on fatigue characteristics of Ti and Ti alloys; effect of strain rate on the creep and tensile performance of Ti alloys; relationship between microstructural conditions of Ti base alloys and mechanical properties at high temperatures; creep rupture behavior of Ti and Ti alloys at high temperature; tensile and impact properties of Ti over a range of temperatures; effect of strain rate, temperature, notches, and H control on the mechanical properties of Ti and Ti alloy; and the preparation of high-strength Ti alloys of good ductility and toughness. (C.H.)

2285 NP-5514
Case Inst. of Tech.
THE EFFECTS OF STRESS CONCENTRATION AND TRIAXIALITY ON THE PLASTIC FLOW OF METALS. TECHNICAL REPORT NO. 31. DUCTILITY OF STEELS WITH DIFFERENT AMOUNTS OF HYDROGEN. Taiji Toh and W[illiam] M. Baldwin, Jr. Jan. 1955. 27p. Contract N6-ONR-273/I.

The ductility of an SAE 1020 steel cathodically charged to different hydrogen contents was determined as a function of strain rate and temperature. While there is an apparent justification for interpreting the data in the light of a mechanism that views hydrogen embrittlement as a competition between strain rate which if it preponderates leads to ductile behavior and an embrittling rate, β, equal to KDPC (where K is a constant, D, the diffusion rate of hydrogen in ferrite, P, the pressure of hydrogen in the microvoids of the steel, and, C, the concentration of hydrogen in solid solution in the steel), there are a number of arguments—chief among which is the fact that cathodic charging embrittles only the surface layers of a steel—against such a simple or direct interpretation of the data. (For preceding report in series see NP-5400.) (auth)

2286 NP-5518
Metallurgical Advisory Committee on Titanium
STATUS BULLETIN NO. P8 ON UNCLASSIFIED TITANIUM RESEARCH AND DEVELOPMENT OF ARMY ORDNANCE CORPS. Feb. 1953. 63p.

The results of cooperative studies on the production and properties of Ti and Ti alloys are briefly outlined. (J.E.D.)

2287 NP-5519
Metallurgical Advisory Committee on Titanium
STATUS BULLETIN NO. P9 ON UNCLASSIFIED TITANIUM RESEARCH AND DEVELOPMENT OF ARMY ORDNANCE CORPS. May 1953. 79p.

The results of cooperative studies on this production, metallurgy, and properties of Ti and Ti alloys are briefly outlined. (For preceding report in series see NP-5518.) (J.E.D.)

2288 NP-5520
Metallurgical Advisory Committee on Titanium
STATUS BULLETIN NO. P10 ON UNCLASSIFIED TITANIUM RESEARCH AND DEVELOPMENT OF ARMY ORDNANCE CORPS. Aug. 1953. 71p.

The results of cooperative studies on the production, metallurgy, and properties of Ti and Ti alloys are briefly

outlined. (For preceding report in series see NP-5519.) (J.E.D.)

2289 NP-5521
Metallurgical Advisory Committee on Titanium
STATUS BULLETIN NO. P11 ON UNCLASSIFIED TITANIUM RESEARCH AND DEVELOPMENT OF ARMY ORDNANCE CORPS. Nov. 1953. 52p.

The results of cooperative studies on the production, metallurgy, and properties of Ti and Ti alloys are briefly outlined. (For preceding report in series see NP-5520.) (J.E.D.)

2290 NP-5522
Metallurgical Advisory Committee on Titanium
STATUS BULLETIN NO. P12 ON UNCLASSIFIED TITANIUM RESEARCH AND DEVELOPMENT OF ARMY ORDNANCE CORPS. Feb. 1954. 59p.

The results of cooperative studies on the production, metallurgy, and properties of Ti and Ti alloys are briefly outlined. (For preceding report in series see NP-5521.) (J.E.D.)

2291 NP-5523
Metallurgical Advisory Committee on Titanium
STATUS BULLETIN NO. P13 ON UNCLASSIFIED TITANIUM RESEARCH AND DEVELOPMENT OF ARMY ORDNANCE CORPS. May 1954. 62p.

The results of cooperative studies on the production, metallurgy, and properties of Ti and Ti alloys are outlined. (For preceding report in series see NP-5522.) (J.E.D.)

2292 NP-5524
Metallurgical Advisory Committee on Titanium
STATUS BULLETIN NO. P14 ON UNCLASSIFIED TITANIUM RESEARCH AND DEVELOPMENT OF ARMY ORDNANCE CORPS. Aug. 1954. 58p.

The results of cooperative studies on the production metallurgy, and properties of Ti and Ti alloys are briefly outlined. (For preceding report in series see NP-5523.) (J.E.D.)

2293 NP-5529
Armour Research Foundation
INCREASING THE RATIO OF MODULUS OF ELASTICITY TO THE DENSITY OF TITANIUM ALLOYS. QUARTERLY REPORT NO. 1 [FOR] MARCH 15—JUNE 15, 1954. W. H. Graft and W. Rostoker. July 28, 1954. 16p. Contract AF 33(616-2355.

The preparation of Ti, Ti—C, Ti—Cu, Ti—V, and Ti—Al alloys by nonconsumable and comsumable electrode arc melting and the development of an electrostatic device for the determination of elastic moduli by dynamic excitation are discussed. (J.A.G.)

2294 NYO-7043
Massachusetts Inst. of Tech.
SOLID SOLUTIONS AND GRAIN BOUNDARIES. PROGRESS REPORT NO. 24. B. L. Averbach, M[orris] Cohen, F. Herbstein, J. Hilliard, R. Kaplow, and P. S. Rudman. Dec. 31, 1954. 5p. Contract AT(30-1)-1002, Scope 2.

Progress is reviewed in the thermodynamic study of the aluminum—silver system and the x-ray work on the lithium—magnesium, iron—aluminum, cobalt—platinum, and copper—platinum systems. (For preceding period see NYO-7042.) (auth)

2295 NYO-7073
Massachusetts Inst. of Tech.
FUNDAMENTALS OF COLD WORKING AND RECRYSTALLIZATION. PROGRESS REPORT NO. 17. B. L. Averbach, M[orris] Cohen, S. Allen, M. F. Comerford, and C. Houska. Dec. 31, 1954. 4p. Contract AT(30-1)-1002, Scope 3.

Progress is briefly reported on deformation of Au—Ag alloys and α brass single crystals and imperfections in transformation products, including a Co sample transformed to the close-packed hexagonal phase. (For preceding period see NYO-7072.) (J.A.G.)

2296 WADC-TR-53-71
Rem-Cru Titanium, Inc.
EFFECT OF STRAIN RATE ON THE MECHANICAL PROPERTIES OF TITANIUM-BASE MATERIALS. D. R. Luster, W. W. Wentz, and J. P. Catlin. Sept. 1953. 163p. Contract AF 33(038)-21912. (AD-22977)

The results of this investigation show that at intermediate rates of strain, high purity titanium is not significantly more sensitive to strain rate changes than are some other metals. Nitrogen additions, however, increase the rate sensitivity markedly so that the presence of nitrogen in all commercial titanium-base materials is the probable reason for their high rate sensitivity at intermediate and low strain rates. All of the representative types of titanium alloys were investigated. The substitutional all-alpha alloy showed the most desirable strength-vs-strain rate characteristics. This alloy type exhibited the lowest rate sensitivity at the slow testing speeds thus promising good long-term strength, and also exhibited a relatively rapid strengthening with high rate of strain, thus promising excellent impact resistance. The high impact resistance of the all-alpha alloy was confirmed by Charpy V-notch impact tests. Analysis of the test data and examination of microstructures suggest that all titanium-base material undergo a basically similar change in mode of deformation with changing strain rate and temperature. It is proposed that this change is from slip and/or twinning at high strain rates and/or low temperatures to grain boundary microflow at low strain rates and/or high temperatures. Some evidence is given although further confirmation is required. The effect of strengthening the base material by cold working or alloying appears to be to alter the range of conditions over which this changing mode of deformation takes place. Cold working and alloying also superimpose strain aging, recovery, and transformation effects which further alter the individual characteristics of the various representative titanium-base materials investigated. (auth)

2297 WADC-TR-53-254(Pt.1)
Syracuse Univ.
SURVEY OF LOW-ALLOY AIRCRAFT STEELS HEAT-TREATED TO HIGH STRENGTH LEVELS. PART 1. HYDROGEN EMBRITTLEMENT. George Sachs and Walter Beck. Juen 1954. 95p. Contract AF 33(616)-392. (AD-32731)

Data on hydrogen embrittlement of high-strength steels are presented and analyzed. Many failures in aircraft reported for steel parts having a strength above 200,000 psi and in addition, many failures of steel bolts heat treated to a strength considerably below 200,000 psi were found to be associated with changes in the basic mechanical characteristics of the steel caused by cadmium plating or chromium plating. Heat treating or baking applied to relieve this hydrogen embrittlement were frequently only partly effective. Hydrogen in steel is highly mobile, and this explains the unusual mechanical features of hydrogen embrittle-

ment and the conflicting results of the many tests which were applied to disclose and measure hydrogen embrittlement. The normal strength of a high-strength steel is found to be rarely affected while its ductility may be greatly reduced. Consequently, the strength of test specimens and parts which depends upon ductility may also be much reduced by hydrogen embrittlement. Furthermore, these effects are pronounced at low rates of straining or sustained loading but probably of no significance on impact loading. The magnitude of hydrogen embrittlement also depends greatly upon numerous mechanical, chemical, and electrochemical factors which are encountered in the making, shaping, heat treating, and finishing of aircraft parts. 43 references. (auth)

2298 WADC-TR-54-205
Battelle Memorial Inst.
DEVELOPMENT OF IMPROVED TITANIUM-BASE ALLOYS. Herbert A. Robinson, Paul D. Frost, and Walter M. Parris. Aug. 1954. 134p. Contract AF33(616)-384.

The research program during the past year was centered around six alloys which had shown considerable promise in earlier work as potential aircraft structural materials. The tensile properties of the alloys, as affected by variations in hot working procedures and heat treatments, were evaluated. Outstanding properties were obtained in two alloys: Ti-3Mn-1Cr-1Fe-1Mo-1V and Ti-5Mn-2.5Cr. Several ingots of the Ti-3Mn-complex alloy were prepared. These ingots have been forged and rolled to bar stock for evaluation by several industrial organizations. (auth)

2299 WAL-401/216
Watertown Arsenal Lab.
[METALS FOR LIGHTWEIGHT CONSTRUCTION]. AN INVESTIGATION OF THE MECHANICAL PROPERTIES AND STRUCTURE OF ALLOY WELDS DEPOSITED IN "UNALLOYED" TITANIUM BASE METAL. Carl E. Hartbower and Daniel M. Daley, Jr. Feb. 19, 1954. 80p. (AD-42380)

Methods for improving the strength of weld joints in commercially pure Ti have been investigated. Various compositions in weld joints have been produced by the addition of the arc-melted "unalloyed" base metal to an alloyed weld puddle. The chemical composition of the weld deposit was determined, and the performance of the various alloys was evaluated by mechanical testing. It was found that high C, O, H, and N content in the base metal relative to that of the filler metal has a marked effect on the performance of the weld deposits. Embrittlement in "unalloyed" α-phase weld deposits is a result of excessive C, O, H, and N. Embrittlement in α-β-phase welds is a result of C in excess of 0.10%. An appreciable gain in tensile strength and notch toughness without detriment to tensile or bond ductility is realized by the presence of small amounts of β-phase -stabilizing elements. It appears that higher O, H, and N content can be tolerated by low-alloy binary α-β phase structures. (M.P.G.)

2300

COPPER AND COPPER ALLOYS. A SURVEY OF TECHNICAL PROGRESS DURING 1954. E. Voce. Metallurgia 51, 9-16(1955) Jan.

A report is presented of the progress in the metallurgy of Cu and its alloys. Raw material resources, metallurgy, extraction, fabrication, finishing, and properties are discussed. 167 references. (J.E.D.)

2301

RECENT PROGRESS IN ALLOY AND SPECIAL STEELS. G. T. Harris and E. Johnson. Metallurgia 51, 17-23(1955) Jan.

A review is presented covering developments in the field of constructional steels, tool steels, and corrosion and heat resisting steels. 36 references. (J.E.D.)

2302

PROGRESS IN POWDER METALLURGY. H. W. Greenwood (Powder Metallurgy, Ltd., London, England). Metallurgia 51, 33-5(1955) Jan.

A brief discussion on progress in the field of powder metallurgy, including a reference to progress on Ti, is given. (J.E.D.)

2303

CARBON—A NEGLECTED METALLURGICAL TOOL? Carl E. Swartz. Metal Progr. 67, No. 2, 77-81(1955) Feb.

Sources, bonding, manufacture of shapes, and present and possible metallurgical uses of C and graphite in the foundry, steel mill, continuous casting, and nuclear reactors are discussed. (J.A.G.)

2304

HEAT TREATMENT OF TITANIUM ALLOYS. Leonard D. Jaffe (California Inst. of Tech., Pasadena). Metal Progr. 67, No. 2, 101-8(1955) Feb.

The effects of composition and heat treatment (including martensite and isothermal transformations, cooling rates, and tempering) on the 100% α,β and α' phases of Ti alloys and their microconstituents are compared using published data. (J.A.G)

2305

PROGRESS IN METAL PHYSICS. Volume 5. Bruce Chalmers and R. King, eds. New York, Interscience Publishers, Inc., 1954. 324p.

This series provides reviews in the general area of Metal Physics, a distinct study which has resulted from the union between physics and metallurgy. (L.M.T.)

2306

THE KINETICS OF OXIDATION OF HIGH PURITY NICKEL. E. A. Gulbransen and K. F. Andrew (Westinghouse Research Labs., East Pittsburgh, Penna.). J. Electrochem. Soc. 101, 128-40(1954) Mar.

The effect of time, temperature, and surface pretreatment on rate of oxidation of high-purity nickel is studied for the temperature range of 400° to 750°C using a vacuum microbalance technique. The data are compared to previous studies in the literature and with other metals. Oxidation data are interpreted in terms of the parabolic rate law and classical theory of diffusion. Large deviations from the parabolic rate law are found to occur during the initial stages of reaction and smaller deviations over long periods of time, especially at low temperatures. However, reasonable values of heat and entropy of activation for the over-all reaction can be calculated; these are 41,200 cal/mole and −6.0 entropy units (eu), respectively. Parabolic rate law constants over the temperature range of 550° to 700°C are given by $\longrightarrow A = 3.8 \times 10^{-4} \exp(-41{,}200/RT)$ cm^2/sec. The negative value for entropy of activation for the over-all reaction when corrected for entropy of formation of the vacancies leads to a value of 1.5 for entropy of activation for diffusion. Theoretical considerations suggest that the latter term should have a

value of 1.7 to 3.3 eu. The good agreement between theoretical and experimental entropies of activation suggests that diffusion is occurring largely through the lattice of nickel oxide and not at grain boundaries, at least for the temperature and time region over which analyses were made. A comparison of present data with older studies in the literature shows a large variation in parabolic rate law constants. These variations are interpreted in terms of impurities increasing the concentration of nickel ion vacancies. (auth)

2307

DEPOSITION OF TITANIUM COATINGS FROM PYROSOLS. A. W. Schlechten, M. E. Straumanis, and C. B. Gill (Univ. of Missouri, Rolla). J. Electrochem. Soc. 102, 81-5(1955) Feb.

It has been found that titanium dispersed in fused salts can be deposited on other metals, especially on copper and iron. For example, if a piece of copper sheet is placed in close proximity to a titanium sheet (but not in actual contact) and then the whole is immersed into a fused salt, preferably NaCl or KCl, titanium will transfer to the copper sheet. The thickness of the titanium layer on the copper increases with temperature and time, approaching a maximum thickness of 0.001–0.007 in. (0.025–0.178 mm). Titanium forms a coherent layer on the metals mentioned and protects them from corrosion. The substrate can be dissolved from the reverse side (Fe in $FeCl_2$ Cu in HNO_2); the titanium coating remains. The mechanism of titanium transfer is thought to consist of, first, a titanium pyrosol formation, and then the deposition of these titanium particles upon the other metals forming a titanium rich alloy. Similar behavior has been observed for other metals. (auth)

2308

ENTHALPY AND SPECIFIC HEAT OF YOUR CORROSION-RESISTANT ALLOYS AT HIGH TEMPERATURES. Thomas B. Douglas and James L. Dever. J. Research Natl. Bur. Standards 54, 15-19(1955) Jan.

Specific heats that are believed to be accurate in general to within ±2 percent are reported for four alloys: from 0° to 900°C for 80 Ni-20 Cr and two stainless steels (type 347, containing 18 percent of chromium, 11 percent of nickel, and 1 percent of niobium, and type 446, containing 26 percent of chromium); and from 0° to 300°C for Monel, containing 67 percent of nickel and 30 percent of copper. These values were calculated from enthalpies measured with a drop method and a precision Bunsen ice calorimeter. The relatively small amounts of heat lost by the alloys as they dropped from the furnace to the calorimeter were estimated and corrections were applied therefor. Discontinuities in specific heat were found only in the case of 80 Ni-20 Cr and the stainless steel type 446. (auth)

2309

EFFECT OF TEMPRATURE ON THE TENSILE PROPERTIES OF A COMMERCIAL AND A HIGH-PURITY 70-PERCENT-NICKEL-30-PERCENT-COPPER ALLOY. William D. Jenkins, Thomas G. Digges, and Carl R. Johnson. J. Research Natl. Bur. Standards 54, 21-36(1955) Jan.

Short-time tensile tests were made at temperatures ranging from 75° to 1,700°F on two 70% Ni-30% Cu alloys. The experimental evidence showed that discontinuous flow occurred in specimens of both alloys fractured in tension at temperatures ranging from 300° to 1700°F. This phenomenon was attributed to stain-aging at the lower temperatures and to recrystallization accompanied by grain growth at the higher temperatures. Variations in chemical composition of the two alloys also affected the degree of strain-aging, strength and ductility properties, and fracture characteristics. (auth)

2310

THE STRUCTURE OF T(AlFeBe). P. J. Black (Cavendish Lab., Cambridge, England). Acta Cryst. 8, 39-42(1955) Jan.

The crystal structure of an intermetallic compound with formula $FeAl_2Be_{2.2}$ has been determined by single-crystal methods. It is a Laves phase of the $MgCu_2$ type, with the iron and beryllium ordered in the copper sites of $MgCu_2$ so that the symmetry is reduced from cubic to monoclinic. The interatomic distances are consistent with those found in other beryllium compounds and there is no evidence that electron concentration is an important factor for this structure. The crystals frequently occur as twins; this is discussed in terms of the proposed structure. (auth)

2311

THE STRUCTURE OF $FeAl_3$. I. P. J. Black (Cavendish Lab., Cambridge, England). Acta Cryst. 8, 43-8(1955) Jan.

This intermetallic compound has a monoclinic structure, space group C2/m, with 100 atoms per unit cell and 42 atomic parameters. The analysis was first performed by a special application of Patterson sections. A projection of the primitive unit cell was used for refinement which gave all the parameters in one two-dimensional synthesis. The process of refinement and the accuracy of the parameters are considered, but discussion of the results is deferred to a subsequent paper. (auth)

2312

NEUTRON DIFFRACTION STUDIES OF THE MAGNETIC STRUCTURE OF ALLOYS OF TRANSITION ELEMENTS. C. G. Shull and M. K. Wilkinson (Oak Ridge National Lab., Tenn.). Phys. Rev. 97, 304-10(1955) Jan. 15.

Neutron diffraction results are presented for a series of alloys of transition elements as an investigation of their magnetic structure. Ferromagnetic disorder scattering has been found for alloys in the disordered state and magnetic superstructure scattering is observed for ordered alloys. Such magnetic scattering when combined with magnetization data offers information on the individual atomic magnetic moments present in the alloy. In general the atomic magnetic moments deviate from their pure elemental values as a function of alloy composition. Scattering data and magnetic moment information are given for members of the Fe–Cr, Ni–Fe, Co–Cr, and Ni–Mn series of alloys. (auth)

2313

SPOT WELDING ALUMINUM WITH SINGLE PHASE EQUIPMENT. J. W. Kehoe and D. R. McCutcheon (Westinghouse Electric Corp., East Pittsburgh, Penna.). Welding J. (N. Y.) 10, 966-86(1954) Oct.

A spot welding schedule has been developed whereby the 3SH14, 52SH34, 61ST6, and 24ST3 Al alloys in thicknesses of 0.032, 0.064, 0.091, and 0.125 are spot welded to each similar and dissimilar alloy and thickness on single phase, 60 cycle frequency equipment. This is possible with standard up and down slope controls, with and without dual welding forces. The importance of low inertia force systems for use on work which is to be welded to Military Specification Standards is brought out. On commercial applications, no special force systems are required. The welding machine should have a good operating force system and when used with the tabulated schedules, very high quality and consist-

ent spot welds can be obtained with single weld forces. Many illustrations prove the difficult in obtaining quality welds without up and down slope controls, using single and dual (forge) forces despite high tensile shear strengths. This opened up an investigation into low inertia force systems, single and dual forces, and up and down slope controls which further developed engineering design information including minimum overlaps, spot spacings and edge distances, as well as electrode combinations and welding schedules for production use. This investigation also uncovered dissimilar alloy and thickness combinations wherein the weld nugget formation between the materials could not be discerned, yet high tensile-shear strengths are obtained. Very high quality spot welds which will meet any present Commercial or Military Specification can be obtained with single phase equipment if the welding schedules are followed. These welds are obtained with recommended currents that are lower than any hitherto-printed schedule for single-phase equipment. (auth)

2314

METALLURGICAL ASPECTS OF WELDING PRECIPITATION-HARDENING STAINLESS STEELS. C. W. Funk and M. J. Granger (Aerojet-General Corp., Azusa, Calif.). Welding J. (N. Y.) 10, 496s-508s(1954) Oct.

Aircraft materials of construction are compared with respect to yield strength to weight ratio at ambient and elevated temperatures, corrosion resistance and characteristics during fabrication. Mechanical properties and structural changes are discussed for four types of stainless steels—Stainless W, 17-7PH, 17-4PH, and V2B. The microstructure is discussed in conjunction with its response to alloying elements and heat treatment as well as its effect on mechanical properties. The mechanisms and procedures of annealing, transformation and precipitation-hardening are discussed relative to improved ductility in welded joints. Observations at Aerojet-General Corp. include a chemical analysis of weldments, studies of porosity, abnormalities in the heat-affected zone, and nonfusion effects. It is believed that porosity in welds is due to entrapped gas, which may originate either from excess water vapor carried in the shielding gases or from evolution of dissolved gas from the parent metal. The chemical composition of 17-7PH, and particularly its high aluminum content, is responsible for nonfusion defects, while variation of the composition greatly influences the response of the alloy to heat treatment. (auth)

2315

EFFECTS OF PRESTRESSING ON FATIGUE STRENGTH OF SPOT-WELDED STAINLESS STEELS. Andre Choquet, V. N. Krivobok, and Georges Welter. Welding J. (N. Y.) 10, 509s-23s(1954) Oct.

Engineers in various fields have expressed interest in the fatigue properties of austenitic stainless steel joined by the spot-welding method. Fatigue strength of various metals and alloys are often judged by their ratio to tensile strength or shear strength; however, it was evident that this tensile strength-fatigue strength ratio cannot be applied to stainless steel spot-welded joints. Fatigue tests performed on 1, 2, 3, and other multiple-spot-welded sheet specimens produced data on the effect of such variables as spot pattern, inter-spot distances, etc. In addition, experimental data were found on the important improvement obtainable in fatigue characteristics if prestraining is performed on the spot weld. This increase is evident whether the straining is accomplished by "hydrostatic" compression, simple compression, tension, or hand peening. Hydrostatic compression produces the greatest improvement, with a gradual increase in fatigue strength taking place as the hydrostatic compression load is increased to 400,000 psi. Progressive loading or "training" of specimens after hydrostatic compression, proves that a large number of cycles at lower loads will not alter the beneficial effect of prestressing. In addition to prestressing, by hydrostatic means, simple compression, tension, and hand-peening methods may be employed to obtain significant increases in fatigue characteristics of these spot-welded joints. The mechanism (emphasis on origin, location, and path) of fatigue failure in spot-welded samples is ascertained as well as the probable limits of a ratio between fatigue strength of parent metal and that of a spot-welded joint. (auth)

2316

UNDERWATER METALLIC ARC WELDING. Rober C. Waugh and Otto P. Eberlein. Welding J. (N. Y.) 10, 531s-4s(1954) Oct.

Operating characteristics, penetration, barrel length, bead geometry, and particle distribution for different waterproofing coatings on electrodes in underwater welding are discussed. Results showed that underwater welding is characterized by a finer particle size distribution than above-water welding for all electrode-waterproofing combinations; the magnitude of current leakage through the coating was form 10 to 20%; specific electrode type and waterproofing agent used determined the characteristics attained; electrodes waterproofed with the same agent had approximately the same barrel length and depth of penetration on above-water welding; variation on barrel length and depth of penetration with the type of waterproofing coating for a given electrode is greater than for above-water welding; and waterglass causes a coarse particle size distribution and lacquer causes a fine particle size distribution as waterproofing agents for all electrodes in both above- and below-water welding. The E-6013 electrode (AWS classification) with a shellac waterproof coating was observed to be superior to other combinations as to maximum depth of penetration and avoidance of undercutting. (J.A.G.)

2317

A PHASE DIAGRAM FOR 1 PER CENT CARBON–IRON ALLOYS CONTAINING UP TO 16 PER CENT NICKEL. P. Samuel, L. G. Finch, and J. R. Rait (Hadfields, Ltd., East Hecla Works, Sheffield, England). Nature 175, 37-8(1955) Jan. 1.

2318

EFFECT OF PARTICLE SIZE ON THE GRAIN GROWTH OF SINTERED METAL. Kazuhiko Ogawa (Kyoto Univ., Japan), Gentaro Matsumura (Government Industrial Research Inst., Nagoya, Japan), and Daizo Okubo (Tungaloy Products Co. Ltd., Kawasaki, Japan). Monatsh. chem. 85, 1281-6(1954) Dec. (In German)

2319

A TUNGSTEN COIL FURNACE FOR HIGH-TEMPERATURE X-RAY DIFFRACTION INVESTIGATIONS. I. J. McKeand and R. K. Hursh (Univ. of Illinois, Urbana). J. Am. Ceram. Soc. 38, 63-5(1955) Feb.

A furnace with a tungsten coil as the heating element has been designed and built for use with the x-ray diffraction spectrometer in the study of phase changes and equilibria at high temperatures. Tests indicate that temperatures up to

2000°C can be reached and maintained for long periods of time in a neutral atmosphere. Materials which are not readily affected by the tungsten vapors that are present can be heated successfully in this type of furnace. (auth)

2320

INVESTIGATION OF BISMUTH ALLOYS AT VERY LOW TEMPERATURES. N. E. Alekseevskiĭ and Yu. P. Gaĭdukov. Zhur. Eksptl'. i Teoret. Fiz. 25, No. 3, 383-4(1953). (In Russian)

It was found experimentally that the intermetallic compound Bi_2Pt displays superconductivity. The $H_c(T)$ relationship is expressed by the formula $H_c/H_0 + (T/T_c)^2 = 1$, where $H_0 = 9.5$ Oe and $T_c = 0.155$°K, which is so far the lowest recorded superconductivity transition temperature. The BiPt alloys gave uncertain results, and the measurements must be repeated. Bi_2S_3 did not display superconductivity down to 0.1°K; Bi_4Rh displayed superconductivity only in hardened state. (Science Abstracts)

2321

GRAIN-BOUNDARY MOVEMENT, SLIP, AND FRAGMENTATION DURING CREEP OF ALUMINIUM–COPPER, ALUMINIUM–MAGNESIUM, AND ALUMINIUM–ZINC ALLOYS. D. McLean and M.H. Farmer (National Physical Lab., Teddington, Middlesax, England). J. Inst. Metals 83, 1-10 (1954) Sept.

Three polycrystalline aluminum alloys (aluminum–copper, aluminum–magnesium, and aluminum–zinc) have been tested in creep, and observations have been made of the movements at grain boundaries, of slip, and of the fragmentation of the original crystals into subcrystals. It is concluded that slip and grain-boundary displacement take place concurrently and bear a constant ratio to one another during a given test. The magnitude of this ratio depends on the conditions of the test. (auth)

2322

FATIGUE PHENOMENA IN HIGH-STRENGTH ALUMINUM ALLOYS. R. F. Hanstock (High Duty Alloys, Ltd., Slough, Bucks, England). J. Inst. Metals 83, 11-15(1954) Sept.

The increase in damping capacity that precedes fatigue failure of the aluminum alloys L65 and D.T.D. 683 is associated with precipitate instability. In the alloy D.T.D. 683 localized bands of precipitation have been found, and these are regions where fatigue cracks eventually form. The localized effects of cyclic stressing do not seriously impair the static strength, but the fatigue strength depends on the magnitude of the stress required to initiate precipitation and on the strength of the over-precipited regions. An alloy that derives its high static strength from a controlled state of precipitation that is unstable under cyclic stressing will have a high ratio of static ultimate strength to fatigue strength. (auth)

2323

THE AGEING CHARACTERISTICS OF SOME TERNARY ALUMINIUM–COPPER–MAGNESIUM ALLOYS WITH COPPER: MAGNESIUM WEIGHT RATIOS OF 7:1 AND 2.2:1 H. K. Hardy (Fulmer Research Inst. Ltd., Stoke Poges, Bucks, England). J. Inst. Metals 83, 17-34(1954) Sept.

To extend the results of work on the binary aluminum–copper alloys and to explore the mechanism of precipitation, an investigation has been undertaken into the aging characteristics of two series of ternary aluminum-base alloys containing copper and magnesium in the proportions 7:1 and 2.2:1, respectively. Hardness/aging-time curves were obtained at 30, 110, 130, 165, 190, 220, 240, 260°C. At 110 and 130°C the more highly alloyed materials of the 7:1 series showed two flat plateaux of relatively constant hardness, separating three hardening stages; while two-stage aging curves (one flat plateau) occurred up to 220°C. Alloys from the 2.2:1 series (approximately pseudo binary aluminum–S (Al_2CuMg) phase) gave one flat plateau on the aging curves up to 240°C. The first stage of hardening occurred very rapidly and led to extremely lengthy flat plateaux. Three-stage aging curves were not encountered in this series. Owing to the rapidity of the first rise in hardness, however, the distinction because somewhat arbitary, as a second plateau might have been present at aging times shorter than those investigated. It was not possible to synthesize the aging curves for alloys in the 7:1 series by combining the results from the 2.2:1 series and the earlier results on binary alloys. Metastable solubility curves for the decomposition product responsible for the flat plateaux were shifted to higher temperatures as the magnesium content was raised. In the ternary section the solubility curves approach the binary aluminum–copper side at a very shallow angle. The greatly increased supersaturation with respect to this decomposition product accounts for the fact that small additions of magnesium accentuate and accelerate the aging of aluminum–copper alloys at room and slightly elevated temperatures. The form of the aging curves explains why reversion to the quenched hardness becomes more difficult with increasing magnesium content. The pseudo binary aluminum–S phase alloys gave flat plateaux up to a least 240°C, which may be expected to limit the fall in hardness on a reversion treatment. At 260°C, which may be expected to limit the fall in hardness on a reversion treatment. At 260°C the rise to peak hardness occurs very rapidly, which again militates against the possibility of successful reversion. (auth)

2324

THE FORMATION AND REMOVAL OF TWINS IN TITANIUM DURING DEFORMATION. A. T. Churchman (Associated Electrical Industries, Ltd., Aldermaston, Berks, England). J. Inst. Metals 83, 39-40(1954) Sept.

The deformation twins produced in Ti single crystals by bending can be removed by unbending or annealing the crystal. (auth)

2325

THE SELECTIVE OXIDATION OF NICKEL–CHROMIUM ALLOYS AT HIGH TEMPERATURES. J. Morean (Institut de Recherche de la Sidérurgie, Saint Germain-en-Laye, France) and J. Benard (Faculte des Sciences de Paris, France). J. Inst. Metals 83, 87-93(1954) Nov.

The mechanism of selective oxidation of a nickel–4.6% chromium alloy has been studied between 800 and 1250°C, using mixtures of hydrogen and water vapor as oxidizing agent. The morphology of the oxide formed on the surface of the alloy differs markedly from the surface structure of the unoxidized metal. Nucleation of Cr_2O_3 is followed by its coalescence; at a later stage the primary oxide evaporates and the bare metal takes on a striated appearance. Various aspects of the observations are discussed, in particular the surface striations. In an oxidizing atmosphere, the surface of the specimen may be considered not as a free-metal/atmosphere boundary, but as a metal/oxide interface. Selective oxidation of the chromium contributes to the building-up of this surface oxide film; when the temperature is sufficiently high, the lattice of the metal beneath undergoes a

reorganization, as a result of which the metal surface is enabled to adopt the micro-profile corresponding to its state of minimum free energy. (auth)

2326

THE FABRICATION OF CHROMIUM AND SOME DILUTE CHROMIUM-BASE ALLOYS. F. Henderson, S. T. Quaass, and H. L. Wain (Aeronautical Research Labs., Melbourne, Australia). J. Inst. Metals 83, 126-32(1954) Dec.

Arc-melted electrolytic chromium can be fabricated by forging, swaging, and rolling. Forging and swaging were carried out at 900°C, and rolling in the temperature range 400 to 900°C. As-deposited electrolytic chromium of sufficient purity, and with an electropolished surface, is shown to be ductile at room temperature after heating to 850°C, which removes internal stresses, considerably reduces the hydrogen content, and produces grain growth in the deposit. This material remains ductile after arc casting and after the various fabricating processes mentioned above, provided that contamination is reduces to a minimum. Alloys of chromium containing 1 wt.% titanium and up to 5 wt.% tungsten can be fabricated by the methods used for pure chromium, and the products are ductile at room temperature; however, this technique was not successful with higher alloy contents. (auth)

2327

ELECTRON-OPTICAL METHODS IN CONSTITUTIONAL METALLURGY. J. W. Menter (Univ. of Cambridge, England). J. Inst. Metals 83, 185-92(1954) Dec.

The use of electron diffraction makes it possible to determine the crystallographic nature and chemical identity of surface constituents. The value of electron diffraction is enhanced when used in combination with electron-microscopic methods either in transmission or reflection. (J.E.D.)

2328

AN APPARATUS FOR ELECTROPOLISHING SPECIMENS FOR METALLOGRAPHIC EXAMINATION. E. C. Sykes, V. J. Haddrell, H. R. Haines, and B. W. Mott (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inst. Metals 83, 166-8(1955) Jan.

An apparatus for electropolishing specimens of uranium or other metals is described, together with experiments with machines incorporating various methods of dispersing the anodic layer. The polished specimens are characterized by a complete freedom from flow lines produced by concentration of gas bubbles in the direction of flow of the electrolyte, as encountered with some units commercially available. The appratus is cheap to build and is free from attack by even the most corrosive electrolyte likely to be used. (auth)

2329

A STUDY OF THE BEHAVIOUR OF TITANIUM-RICH ALLOYS IN THE TITANIUM–TIN AND TITANIUM–ALUMINIUM SYSTEMS. A. D. McQuillan (Univ. of Birmingham, England). J. Inst. Metals 83, 181-4(1955) Jan.

The hydrogen-pressure method has been used to study the effect of aluminum and tin on the $\alpha \rightleftharpoons \beta$ transformation in titanium. Additions of up to 1 at.% aluminum have little effect on the transformation, but greater amounts cause a progressive increase in the temperature of the transformation. A slight distortion of the $(\alpha + \beta)$ region at about 3 at.% aluminum was found. On addition of tin to titanium the transformation temperature is first depressed to a minimum point at 6.5 at.% tin and 845° ± 2°C, and thereafter increases with increasing tin concentration. Anomalous relationships between the hydrogen equilibrium pressure and temperature have been observed in the single-phase titanium–tin alloys and between hydrogen equilibrium pressure and hydrogen concentration in α-phase titanium–aluminum alloys. (auth)

PHYSICS

2330 AECU-2990

North American Aviation, Inc

RECENT PROGRESS IN SOLID-STATE PHYSICS—NUCLEAR ENGINEERING AND MANUFACTURING. [nd]. 9p. Contract [AT-11-1-GEN-8].

A theoretical analysis of void formation in metals on one side of the interface in Kirkendall-type diffusion experiments has been completed. The existence of an excess concentration of vacancies was not assumed. Studies are being made of lattice defects in cold-worked Cu, Au, and Th, and in cyclotron-irradiated Cu. Temperature ranges for the migration of interstitial atoms and vacancies were determined in some cases. The effect of specific imperfections on the mechanical properties of Cu has been studied by determining the effect of annealing after cyclotron bombardment or cold work on the shear modulus of wires. The temperature dependence of the thermal conductivity of graphite is being studied. It has been observed that the conductivity of polycrystalline graphite varies more rapidly with temperature than does the specific heat. A two-media theory appears to explain the anomaly. Attention has been given to the state of KCl containing an excess of alkali metal. Calculations indicate that the colloidal particles present after the proper heat treatment of KCl containing an excess of K are probably in a highly compressed liquid state. In other investigations, the reversibility of the additive coloring reaction in KCl has been established. (M.P.G.)

2331 AECU-2991

Laboratory for Nuclear Science, Mass. Inst. of Tech.

PROGRESS REPORT [NO. 35 FOR SEPTEMBER 1, 1954 THROUGH NOVEMBER 30, 1954]. Nov. 30, 1954. 69p. Contract AT(30-1)-905.

Nuclear Chemistry. A study of the halide complexing of In in a Br–In system was undertaken by ultraviolet spectrophotometry. With an excess of In and an ionic strength of 4.000M, the stability constant of the first complex is 122 ± 3. An automatic procedure for performing thermometric titrations has been devised. A method was developed for separating Mn from a large number of other cations by precipitation as MnO_2, which is then dissolved and impurities removed by adsorption on a $Fe(OH)_3$ precipitate. An interpretation of metal adsorption from complex-formation media with anion exchangers is proposed. Deuteron excitation cross sections were measured for Cr, and thick-target yields determined for V^{48}, Cr^{51}, Mn^{52}, and Mn^{54}. A substitution mechanism is suggested for the reaction of triphenylmethyl radical with benzoyl peroxide in benzene-t. The rate of hydrogen exchange between triphenylcarbinol-t and a series of aliphatic alcohols was measured by a flow method. The decomposition rate of 0.03M benzoyl peroxide in cyclohexane was measured with varying styrene concentrations. The rate rapidly de-

creases up to concentrations of 0.1M, and more slowly thereafter. Elementary Particle Scattering. Data for previously described experiments on the photoproduction of high-energy protons in coincidence with neutrons are given. ONR Generator. Q values and proton yields for the $B^{10}(\alpha,p)C^{13}$ reaction were studied. Similar investigations are reported on the $Cl^{35}(d,\alpha)S^{33}$ and $Cl^{35}(d,p)Cl^{36}$ reactions. Angular distributions of the proton groups from Ca(d,p) and $Al^{27}(d,p)Al^{28}$ reactions were observed. New energy level data were obtained for Ca^{48} and V^{51}. Cyclotron Group. The angular distribution of inelastically scattered deuterons by several metals has been extended to smaller angles. Synchrotron Group. Cross sections per nucleon have been measured for γ scattering from C targets at 94 and 77 Mev. (For preceding report in series see AECU-2973.) (K.S.)

2332 MLM-997

Mound Lab.

THE VISCOSITY OF BENZENE. (INFORMATION REPORT). J. R. Heiks and E[dward] Orban. Aug. 3, 1954. 12p. Contract AT-33-GEN-53.

A viscometer suitable for measurement of viscosities of fluids at elevated temperatures and pressures is decribed. The time of fall of a radioactive plummet is determined by means of two sets of coincident ionization chambers and an electronic timer. The viscosity of benzene was measured from 90°C to its critical temperature. From 90 to about 180°C the variation of the logarithm of the viscosity of benzene with the reciprocal of the temperature is a straight line, but above this temperature the rate of change increases with increasing temperature. (auth)

2333 NYO-3956(Suppl.)

Tufts Coll.

THE HEAT OF FORMATION OF SODIUM HYDRIDE. SUPPLEMENT TO [THE HEAT OF FORMATION OF LITHIUM, SODIUM AND POTASSIUM HYDRIDES]. Charles E. Messer and Ludwig G. Fasolino. Sept. 1, 1954. 4p.

Values are given for the heats of formation and hydrolysis of NaH. (J.A.G.)

2334 UCLA-322

Atomic Energy Project, Univ. of Calif., Los Angeles

SPECTRAL DOSE RATE DISTRIBUTION IN THE X-RAY BEAM FROM A BERYLLIUM WINDOW TUBE OPERATED AT 50 K.V.P. Amos Norman and M. A. Greenfield. Feb. 3, 1955. 19p. Contract AT-04-1-GEN-12.

The dose rate distribution of the x-ray beam from a beryllium window tube operating at 50 kv was computed from the aluminum filtration data by the Laplace transform method. The results are compared with those calculated from Kramer's formula and with the widely quoted x-ray spectrometer measurements of Ulrey. (auth)

2335 WADC-TR-53-211

California Univ., Los Angeles

[EFFECTS OF ATOMIC WEAPONS ON AIRCRAFT SYSTEMS]. TEMP-TAPES: IMPROVED DESIGN, CONSTRUCTION, AND CALIBRATION. Alphonso Ambrosio and Bertram Bussell. July 1953. 35p. Contract AF33(616)-293. (AD-27589)

The Temp-Tape, a remote maximum temperature measuring device, was redesigned, constructed and calibrated. The redesign resulted in a tape $\frac{3}{4}$ by $1\text{-}\frac{3}{4}$ inches containing 18 different eutectics or pure metals. Each metal is shaped as an equilateral triangle, 0.1 inches on a side. Temperature indications are obtained from the physical distortions caused by heating the various low melting point eutectics and pure metals. These distortions appear as changes in surface texture, rounding of edges and corners, and complete changes in shape. The temperature range of the Temp-Tape is 117°F to 520°F. The accuracy of the measurement varies depending on the portion of the temperature range being utilized. An accuracy of 10°F is obtainable over a large part of the range. (auth)

2336

THERMAL CONDUCTIVITY MEASUREMENTS OF VISCOUS LIQUIDS. James H. Boggs and Wilmer L. Sibbitt (Purdue Univ., Lafayette, Ind.). Ind. Eng. Chem. 47, 289-93(1955) Feb.

Data on the thermal conductivity of viscous polymers are very meager. No data are available on the thermal conductivity of viscous aqueous solutions. The thermal conductivities of 18 viscous fluids were measured over a temperature range from 80 to 250°F or to the maximum temperature at which they were stable. Fluids with viscosities as high as 10^6 cs. were studied. It is possible to increase the viscosity of an aqueous solution by a factor of 10,000 without appreciable changing the thermal conductivity. The thermal conductivity of silicone fluids is a function of the visosity for fluids with viscosities below 1000 cs. (auth)

2337

THE PRESENT STATE OF PHYSICS. Frederick S. Brackett, Arranger. A Symposium presented on Dec. 30, 1949 at the New York meeting of the American Association for the Advancement of Science. Washington, American Association for the Advancement of Science, 1954. 265p.

2338

PHYSICAL PROPERTIES OF SOLID MATERIALS. Cornelis Zwikker (National Aeronautical Research Inst., Amsterdam, Netherlands). New York, Interscience Publishers, Inc., 1954 300p.

2339

DIFFUSION OF NITROGEN AND OXYGEN IN TITANIUM. R. J. Wasilewski and G. L. Kehl (Columbia Univ., New York). J. Inst. Metals 83, 94-104(1954) Nov.

The diffusion rates in massive β-titanium, and their temperature dependence, have been determined for nitrogen in the range 900 to 1570°C and for oxygen in the range 950 to 1414°C, assuming D to be independent of the solute concentration. This appears probable in the case of nitrogen throughout the solubilty range in β-titanium; diffusion rates for oxygen, however, appear to decrease at higher solute concentrations. A mathematical analysis has been carried out to account for the initial deviation from the parabolic rate law in gas/metal reactions. An approximately linear reaction rate has been derived for short reaction times. The case of diffusion with simultaneous formation and growth of a thin surface layer has also been analyzed. An expression has been derived permitting approximate calculation of the diffusion coefficient of the solute in the surface layer from obtainable experimental data, when the layer is too thin for experimental determination of the concentration distribution. This analysis was used to evaluate the diffusion coefficients of nitrogen in α-titanium and titanium nitride between 900 and 1570°C. (auth)

2340

THE SURFACE TENSION OF SODIUM. J. W. Taylor (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inst. Metals 83, 143-52(1954) Dec.

A redetermination has been made of the surface tension of sodium, and its temperature coefficient has been established over the range 98 to 450°C. The maximum-bubble-pressure method of measurement was employed. The surface tension at the melting point, relative to an argon atmosphere, is 190.8 dynes/cm and the temperature coefficient over the range studied is —0.1 dyne/cm/°C. The presence of an oxide film on the sodium surface increases the surface tension, and this effect may account for the discrepancy between the present and previous data. The surface-tension values are in keeping with several empirical relationships existing between this property and other physical constants of liquid metals. A comparison of the values obtained by experiment with those calculated theoretically does nothing to substantiate the validity of the former owing to the uncertainty in the latter; likewise the experimental result does not indicate which theoretical treatment is the most accurate. (auth)

2341

THE RUBIDIUM TRANSITION AT ~180°K. F. M. Kelly and W. B. Pearson (National Research Council, Ottawa, Canada). Can. J. Phys. 33, 17-24(1955) Jan.

Resistivity measurements have shown the presence of a "transition" in Rb at ~180°K. The nature of this transition has been further investigated by dilatometric and x ray studies of thermal expansion, thermoelectric force measurements, and x ray examination for the possibility of a change of crystal structure. Evidence for the transition in properties other than resistance measurements is very variable and, although the transition does not appear to involve a change of crystal structure, its characterization as an electronic change remains obscure. Analysis of resistance measurements shows that the resistive behavior of Rb above 180°K must be regarded as anomalous. (auth)

2342

SURFACE TENSION OF He^3. D. R. Lovejoy (Univ. of Toronto, Canada). Can J. Phys. 33, 49-53(1955) Feb.

The surface tension of He^3 has been measured by a capillary rise method between 1.08° and 2.32°K. A decrease of more than 50% was observed in this range and this supports the ideas on which Atkins' theory of the surface tension of liquid helium is based. On the basis of this theory the surface tension has been extrapolated to 0°K, where it has the value 0.154 ± 0.005 erg cm^{-2}. Above 2.3°K it was extrapolated linearly to zero at the critical temperature. The Eötvös constant was calculated to be about 0.8. (auth)

2343

REMARKS ON THE MECHANISM OF ELECTROLUMINESCENCE. R. Goffaux (Laboratoire de Recherches Physiques des A. C. E. C., Charleroi, Belgium). Bull. classe sci. Acad. roy. Belg. 40, No. 8, 808-14(1954). (In French)

Several details of the electroluminescent process are analyzed, particularly the electron supply to the conduction band of P, and the intensity saturation effect at high frequency. (tr-auth)

2344

MEASUREMENT OF PARTICLE SIZE DISTRIBUTION OF PROSPHORS. Martha J. Bergin and Keith H. Butler (Sylvania Electric Products Inc., Salem, Mass.). J. Electrochem. Soc. 101, 149-54(1954) Mar.

A quick method of calculating particle size distribution from optical measurements of sedimentation rates is described. It is shown that the apparent mean diameter is greatly influenced by degree of dispersion of the powder and that reproducibility requires careful control of dispersion. (auth)

2345

NITRIDES OF CHROMIUM AND CHROMIUM-TITANIUM ALLOYS. NEW FILM-TYPE RESISTANCE ELEMENTS. E. R. Olson, E. H. Layer, and A. E. Middleton (Battelle Memorial Inst., Columbus, Ohio). J. Electrochem. Soc. 102, 73-6(1955) Feb.

Some electrical properties of nitrided Cr and nitrided Cr—Ti films are presented. Films of chromium and Cr—Ti alloys, deposited on ceramic bases by vacuum-evaporation methods, were nitrided to form electrical resistance elements. By varying thickness and nitriding conditions, the electrical properties of the films can be varied. Materials can be prepared with temperature coefficients of resistance less than 0.01%/°C. Resistors with resistances of from several hundred to several million ohms can be made. Resistance to environmental attack and other properties are also described. (auth)

2346

ISOTOPIC COMPOSITION OF BROMINE IN NATURE. A. E. Cameron and E. L. Lippert, Jr. (Carbide and Carbon Chemicals Co. Oak Ridge, Tenn.). Science 121, 136-7(1955) Jan. 28.

The isotopic ratio was determined in elemental Br samples from the Mich. brines, Searles Lake, Pacific Ocean, and the W. Va. brines and in ethylene dibromide samples from Gulf water. No significant difference appeared to exist exist among the samples. The average value of Br^{79}/Br^{81} was found to be 1.0217 ± 0.0002. (M.P.G.)

2347

UNIVERSITY OF PENNSYLVANIA RADIOCARBON DATES. I. Elizabeth K. Ralph (Univ. of Pennsylvania, Phaladelphia). Science 121, 149-51(1955) Feb. 4.

Data are presented on the dates, as determined by C^{14} dating, of samples of charcoal collected from many levels in Belt Cave and Hotu Cave situated on the southern Caspian shore of Iran. Data are compared with counting rates for samples of known age and archeological specimens. (C.H.)

2348

MEASUREMENT OF TIME VARYING OPTICAL ABSORPTION. A. V. Phelps and J. L. Pack (Westinghouse Research Labs., East Pittsburgh, Penna.). Rev. Sci. Instr. 36, 45-9(1955) Jan.

Time sampling techniques have been applied to the study of optical absorption transients. The method is described in terms of its use for the study of the decay of the concentration of metastable atoms following a pulsed discharge. Light from a capillary source is passed through the discharge tube. The transmitted intensity of one of the spectral lines which is absorbed by the metastable atoms is measured using an interference filter and a gated photomultiplier. The photomultiplier gate occurs at twice the discharge frequency so that alternate pulses of the photomultiplier output are reduced by absorption. The component of the photomultiplier output at the discharge frequency is proportional to the absorption and can be measured

with a narrow band amplifier and synchronous detector. Since the time resolution of the system is determined by the width of the photomultiplier gate, the response of the synchronous detector can be made slow enough to average the absorption signal over many decay periods. Fluctuations in the number of electrons leaving the cathode of the photomultiplier limit the useful sensitivity of the present system to approximately two parts in 10^4. This represents a hundredfold improvement in sensitivity over that available with previous techniques. The results of some studies of helium metastables are presented in order to illustrate the detail which can be obtained with this technique. (auth)

2349

MILLIMICROSECOND PULSE TECHNIQUES. I. A. D. Lewis and F. H. Wells (Atomic Energy Research Establishment, Harwell, Berks, England). New York, McGraw-Hill Book Co., Inc., 1954. 310p.

Applied electronic pulse techniques in the range 10^{-6} to 10^{-10} sec are considered in relation to basic circuit elements and equipment of universal application. Several chapters are specifically devoted to nuclear physics instrumentation. The book is intended as a particular aid to the physicist with little experience in the electronic art. (K.S.)

2350

NUCLEAR SUSCEPTIBILITY OF LIQUID AND SOLID He^3. P. J. Price (I.B.M. Watson Scientific Computing Lab., New York). Phys. Rev. 97, 259-62(1955) Jan. 15.

An interpretation of the observed deviation from Curie's law of the nuclear paramagnetic susceptibility of liquid helium He^3, based on a "cell" type of model of the liquid, is presented. The theory is able to account qualitatively, but not precisely, for the deviation. The reasons for its imprecision are discussed. The bearing of the point of view of the theory on the paramagnetism of the solid is considered: it is concluded that there should be no deviation from Curie's law at the lower temperatures, but that a small deviation near the rising part of the melting curve is quite possible. (auth)

2351

INTERPRETATION OF THE MAGNETIC BEHAVIOR OF LIQUID HELIUM-3. O. K. Rice (Univ. of North Carolina, Chapel Hill). Phys. Rev. 97, 263-6(1955) Jan. 15.

Recent work indicates that the lining-up antiparallel of nuclear spins in liquid He^3 takes place at temperatures much lower than that which would be expected for an ideal Fermi-Dirac gas. This indicates that the energy gap between the state in which the spins are aligned and one in which they can orient themselves in a magnetic field is lower than in the ideal gas. A model is considered in which pairs of atoms rotate about each other, and it is shown that the energy gap will be less for rigid spheres than for point particles, which more resemble the ideal-gas case. The model based on rigid spheres gives a reasonably shaped curve for the temperature dependence of the magnetic susceptibility, but the energy gap is still too large. If the rotation is hindered the gap is lowered, and a rough estimate of the degree of hinderance of rotation in liquid He^3 could be made. However, it appears likely that cooperative phenomena involving all the atoms play a role; these are discussed and a comparison with He^4 is made. (auth)

2352

TEMPERATURE DEPENDENCE OF ELECTRON MOBILITY IN AgCl. Frederick C. Brown (Reed Coll., Portland, Oreg.). Phys. Rev. 97, 355-62(1955) Jan. 15.

By using improved crystal counter techniques, electron mobility has been investigated as a function of temperature in AgCl. The measurements were made on annealed samples carefully grown from the melt in which the range of conduction electrons was of the order of 10^{-4} cm per volt/cm of electric field strength. At high fields electron trapping in the volume of the crystal is less important and observed mobility is shown to become a constant independent of field. At 86°K, drift mobility was found to be 274 cm^2/volt sec and was reproducible to within 10 percent for several samples. The data on mobility can be fitted down to 86°K by an expression of the form $\mu = 2.54 \times 10^5 T^{-3/2}$, which would suggest interaction of the electrons mainly with acoustic vibrations of the lattice. However, there exists the possibility of scattering by impurities or other imperfections which in combination with optical scattering might also lead to the observed results. Strains play an important role in this material and are shown to be associated both with shallow 0.1-ev traps and with deeper traps. The average energy for production of one electron-hole pair by beta rays is 7.5 ± 0.5 ev. The range of holes in the samples tested, from 86°k to 150°K, was at least less than $1/10$ that of electrons. (auth)

2353

BIBLIOGRAPHY ON PHYSICAL ELECTRONICS. Prepared by Wayne B. Nottingham and Staff. Cambridge, Mass., Addison-Wesley Publishing Co., Inc., 1954. 428p.

References to investigations in the field of physical electronics are restricted to material associated with the concept physical phenomena related to the free electron. The interpretation of such a scope is illustrated by categoric division of the references under gaseous electronics, electron emission and surface phenomena, solid state and conduction, phosphors and luminescence, and photovoltaic phenomena. (K.S.)

AEROSOLS

2354 AD-42465

Southern Research Inst.

APPARATUS FOR INVESTIGATING PARTICLE-SIZE DISTRIBUTION OF AEROSOLS. PROGRESS REPORT FOR JULY [1953]. Joseph L. Hammond, Jr., Arthur E. Williamson, Jr., and A[lbert] L. Thomas, Jr. Aug. 25. 1953. 17p. Contract DA-18-064-CML-2361, Report No. 5.

2355 AD-42466

Southern Research Inst.

APPARATUS FOR INVESTIGATING PARTICLE-SIZE DISTRIBUTION OF AEROSOLS. PROGRESS REPORT FOR MARCH [1954]. Albert L. Thomas, Jr. May 21, 1954. 11p. Contract DA-18-064-CML-2361, Report No. 13.

2356 AD-42467

Southern Research Inst.

APPARATUS FOR INVESTIGATING PARTICLE-SIZE DISTRIBUTION OF AEROSOLS. PROGRESS REPORT FOR SEPTEMBER [1953]. Joseph L. Hammond, Jr. and Edward B. Dismukes. Oct. 19, 1953. 17p. Contract DA-18-064-CML-2361, Report No. 7.

2357 AD-42468

Southern Research Inst.

APPARATUS FOR INVESTIGATING PARTICLE-SIZE

DISTRIBUTION OF AEROSOLS. PROGRESS REPORT FOR OCTOBER [1953]. Joseph L. Hammond, Jr., Arthur E. Williamson, Jr., and Edward B. Dismukes. Nov. 30, 1953. 21p. Contract DA-18-064-CML-2361, Report No, 8.

Progress is reported in the design and construction of a facility for investigating the characteristics of an atmospheric suspension. During this period experiments on the air-elutriation of solid particles for calibration purposes indicate that the approach being used is practical, although the techniques must still be refined. Experiments have also been made to determine the possibility of using stirred settling chambers as a source of aerosols for investigating the characteristics of dilution stages. Data has been taken which yields curves showing the rate of decay of the total particulate concentration in a stirred settling chamber, as well as the rate of decrease of concentration in various equivalent size ranges. On the basis of experiments made it is concluded that it is feasible to investigate dilution stages with such a source. A theoretical analysis was made of the problem of transporting aerosols through tubing. It is concluded that the most serious source of size discrimination in present work lies in horizontal lengths of tubing where the aerosol velocity is small. (auth)

2358 AEC-tr-2077

THE DYNAMICS OF DUST AND ITS INFLUENCE ON DUST CONCENTRATION MEASUREMENTS. (Die Dynamik Des Staubes Und Ihr Einfluss Auf Die Staubgehaltmessungen). W. Fahrenbach. Translated from Forsch. Gebiete Ingenieurw. 2A, 395-407(1931). 31p.

Tests of the influence of dust dynamics on sample collection for dust-content measurements showed that a partically correct sample can be obtained at any place in a dust-carrying gas stream if sufficient measuring points and an accurate adjustment of the velocity in the sampling tube to the velocity of the gas stream at the measuring point are provided for. The laws of the movement of particles derived from Stokes' friction law were applied in the calculations. (C.H.)

2359

THEORY OF COAGULATION AND SETTLING OF AEROSOLS IN TURBULENT GAS FLOW. REMOVAL COEFFICIENT FOR AERSOLOL PARTICLES. V. G. Levich. Doklady Akad. Nauk S.S.S.R. 99, 1041-4(1954) Dec. 21. (In Russian)

COSMIC RADIATION

2360 NP-5515

Washington Univ., St. Louis

COSMIC RAYS. TECHNICAL REPORT NO. 19. THE ESTIMATION OF THE ENERGY OF PHOTON INDUCED SHOWERS (thesis). Paul Albert Bender. Jan. 24, 1955. 47p. Contract N6 ONR-202, T. O. 3.

Three acceptable methods have been found for estimating the energy, E_0, of a shower seen in a multiplate cloud chamber. They are represented by the expressions (1) $E_0 = 87.4N_{max}$, (2) $E_0 = 33.8P$, and (3) $E_0 = 54.5\sqrt{PN_{max}}$, listed in order of increasing exactness, where N_{max} = number of tracks appearing at maximum development and P = track length. Energies determined by expression (3) have an error of ±10%. The expressions are valid only in the energy region from 100 to 1000 Mev. The methods were selected by studying showers resulting from the decay of a neutral π meson into two photons of energies E_1 and E_2. $\sqrt{E_1E_2}$ was calculated from cloud chamber pictures and compared with values of $\sqrt{E_1E_2}$ obtained from the application of various energy estimation methods to the showers. The degree of agreement obtained was considered to be a measure of the reliability of the method. The methods were then compared to shower theory and "Monte Carlo" calculations. (M.P.G.)

2361

THE FLUX OF PRIMARY COSMIC RAY NUCLEI OF ATOMIC NUMBER $Z \geq 2$ AT GEOMAGNETIC LATITUDE 30°. B. Peters (Tata Inst. of Fundamental Research, Bombay, India). Proc. Indian Acad. Sci. 40, 230-48(1954) Dec.

The method of determining the primary flux of nuclei with atomic number $Z \geq 3$ developed by Bradt and Peters has been extended to include all nuclei of charge $Z \geq 2$. It is shown that the method permits the identification of primary helium nuclei with an efficiency $\eta \geq 90\%$. The primary α-particle flux obtained in this way is in very good agreement with that obtained by other methods and the relative flux values for nuclei of atomic number $3 \geq Z \geq 5$ and $6 \geq Z \geq 9$ agree with previous determinations. (auth)

2362

THE ANGULAR DISTRIBUTION OF HIGH ENERGY ELECTRONS IN AIR SHOWERS. I. LANDAU APPROXIMATION. M. H. Kalos (Univ. of Illinois, Urbana) and J. M. Blatt (Univ. of Sydney, Australia). Australian J. Phys. 7, 543-69(1954) Dec.

The angular distribution of high energy ($> 5\times10^8$ ev) electrons in air showers is calculated on a track length basis, using approximation A of Rossi and Greisen (1941) (no ionization loss) and the Landau (1940) multiple scattering approximation. The approximations used are discussed, and their validity is estimated. The basic equations are written down. Qualitative results and very rough solutions are developed and applied to the Furry model of a cascade. For the Furry cascade the qualitative arguments lead directly to an Ansatz which yields an exact solution. In the actual cascade the corresponding Ansatz does not yield an exact solution. We then perform an iteration, employing a general method of Friedman. The final (iterated) solution is compared with the exact (in the Landau approximation) solution by means of their moments, and appears to be within 10% of the correct solution for $E\theta/E_s < 1$. The solution compares well with earlier work on this problem. Appendices contain a short derivation of the angular moments, a general inversion formula for going from the distribution-in-projected-angle to the distribution-in-angle-with-the-shower-axis, and a derivation of the Friedman variation principle in vector space terminology. (auth)

2363

MEASUREMENTS OF THE COSMIC RAY NEUTRON RATE IN THE HIMALAYAS AND AUSTRALIAN ALPS. K. B. Mather (Univ. of Melbourne, Australia). Australian J. Phys. 7, 601-14(1954) Dec.

The variation of α-track density in boron-loaded emulsions and the star rate in C2 emulsions have been measured at the same sites at mountain altitudes at two latitudes. The α-count is proportional to the slow neutron density in the atmosphere while the stars arise chiefly from fast neutrons. The variation with altitude can be represented in each case by a simple exponential of the form: $I = I_0e^{-x/L}$.

Values were derived for the attenuation length L for each latitude: geomagnetic lat. 21 °N., L = 148 (slow neutrons), 139 (stars); geomagnetic lat. 45 °S., L = 141 (slow neutrons), 130 (stars). The close resemblance and direction of variation of L values for neutron flux and star rates is evidence for their generic connection. The latitude variation of L is less than observed in the upper half of the atmosphere. L values are also somewhat smaller than measured at higher altitudes, consistent with a degradation of the nucleon component with increasing atmospheric depth. The star rate in the atmosphere has been calculated to be $\sim 1 \cdot 3$ stars cm^{-2} sec^{-1} at geomagnetic latitude 45 °S. (auth)

2364

PROCESS IN COSMIC RAY PHYSICS. VOLUME II. J. G. Wilson, ed. New York, Interscience Publishers, Inc., 1954. 322p. (cf. NSA 6-5409)

The review of cosmic-ray physics is further extended based on the following topics: nuclear interactions of stopped μ mesons; experimental data on the heavy unstable particles; the penetrating component of cosmic radiation in the upper atmosphere; the development of a nucleon cascade; and particle identification with photographic emulsions and related problems. (L.M.T.)

2365

UNSTABLE CHARGED PARTICLES HEAVIER THAN PROTONS. A. I. Alikhanyan, M. I. Daion, N. V. Shostakovich, V. G. Kirillov-Ugrayumov, and B. N. Deryagin (Physics Inst., Armenian S.S.R. and S.S.S.R.). Doklady Akad. Nauk S.S.S.R. 99, 361-4(1954) Nov. 21. (In Russian)

Four events attributed to decay of T particles are illustrated. Assuming the decay $T^+ \rightarrow n^0 + \pi^+ (\mu^+) + Q$, Q = 66 Mev if a π meson is emitted and 58 Mev if a μ meson is given off. Masses of 2246 and 2160 m_e are given for these alternatives. (G.Y.)

2366

TOWARD A GENERAL THEORY OF THE NUCLEAR CASCADE PROCESS. G. T. Zatsepin and I. L. Rozental (Lebedev Physics Inst., Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 99, 369-72(1954) Nov. 21. (In Russian)

2367

DIMENSIONAL CHARACTERISTICS OF THE NUCLEAR ACTIVE COMPONENT OF EXTENSIVE COSMIC RAY SHOWERS. I. L. Rozental (Lebedev Physics Inst.). Doklady Akad. Nauk S.S.S.R. 99, 963-6(1954) Dec. 21. (In Russian)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

2368

MICROHETEROGENEOUS STRUCTURE OF KCl(Ag+) AND NaCl(Ag+) PHOSPHORS. L. M. Shamovskii and L. M. Rodionova (All-Union Mineral Inst.). Doklady Akad. Nauk S.S.S.R. 99, 381-4(1954) Nov. 21. (In Russian)

2369

F CENTERS IN PURE AND HYDRIDE-CONTAINING ALKALI HALIDE CRYSTALS. R. S. Alger and R. D. Jordan (U. S. Naval Radiological Defense Lab., San Francisco, Calif.). Phys. Rev. 97, 277-87(1955) Jan. 15.

Additional evidence regarding the role of imperfections in the gamma-ray coloring and optical bleaching of the alkali halides has been obtained by comparing crystals with and without U centers. Parameters varied were gamma-ray exposure rate, crystal temperature, hydride concentration, F-band illumination intensity, and thermal history of the crystal. The coloring efficiency increased with temperature, trap depth and vacancy or U-center concentration. Under F-band illumination, both pure and U-centered crystals exhibited an initial period of rapid bleaching, followed by a long slow-bleaching period. Interrupting the bleaching in U-centered crystals by storage in the dark restored the higher bleaching rate. The slow bleaching was temperature-dependent, increased slightly with F-band illumination intensity, and was essentially independent of the U-center concentration. The results support the hypothesis that coloring and bleaching rates are primarily controlled by the availability of suitable holes and vacancies. Crystals containing the hydride color more efficiently than pure crystals because all constituents of the F center are present in the parent U center; whereas pure crystals bleach faster because of the accessibility of the holes. (auth)

2370

SURFACE NUCLEATION IN THE RECRYSTALLIZATION OF ALUMINIUM SINGLE CRYSTALS. C. D. Graham, Jr., (General Electric Research Lab., Schenectady, N. Y.) and R. Maddin (Johns Hopkins Univ., Baltimore, Md.). J. Inst. Metals 83, 169-72(1955) Jan.

Recrystallization nuclei in extended aluminium single crystals are found to lie preferentially in a surface layer about 2.5 to 5×10^{-3} cm deep. This surface-nucleation effect does not depend on crystal orientation (with one exception or on specimen shape, and is also found in fine-grained polycrystalline aluminium. The effect can be eliminated by extending the crystal under an etching reagent, and is considered to result from the presence of an oxide layer on the crystal at the time of straining. An explanation in terms of piled-up dislocations is presented. (auth)

2371

THE INFLUENCE OF SUB-STRUCTURE ON THE SLIP OBSERVED IN PURE ALUMINIUM AND SOME ALUMINIUM ALLOYS WHEN SUBJECTED TO FATIGUE STRESSES. P. J. E. Forsyth and C. A. Stubbington (Royal Aircraft Establishment, Farnborough, Hants, England). J. Inst. Metals 83, 173-5(1955) Jan.

Observations have been made on the modifying effects of substructure on subsequent fatigue deformation at both room and subzero temperatures. Substructures produced by cold rolling altered completely the appearance of the deformation that was produced by subsequent fatigue stresses. A self-annealing process occurred in cold-rolled pure aluminum when subjected to cyclic stresses. It is concluded that fatigue stresses, by virtue of their cyclic nature, aid the polygonization process in pure aluminum and in certain aluminum alloys and may produced very sharply defined boundaries by a process of crystallite growth. (auth)

2372

CRYSTAL CHEMICAL STUDIES OF THE 5f-SERIES OF ELEMENTS. XXIII. ON THE CRYSTAL CHEMISTRY OF URANYL COMPOUNDS AND OF RELATED COMPOUNDS OF TRANSURANIC ELEMENTS. W. H. Zachariasen (Argonne National Lab. and Univ. of Chicago, Ill.). Acta Cryst. 7, 795-9(1954) Dec.

The crystal chemistry of uranyl compounds and of compounds containing the groups $(NpO_2)^{+2}$, $(PuO_2)^{+2}$, $(AmO_2)^{+2}$, $(PuO_2)^{+1}$, and $(AmO_2)^{+1}$ is discussed on the basis of the available structural information. All of these (XO_2) groups

have the symmetrical collinear shape O—X—O. In all of the known crystal structures the X atom forms additional and longer bonds to other oxygen atoms or to fluorine atoms. Four, five, and six such secondary bonds have been observed. The bond length within the XO_2 group as well as the length of the secondary bonds have been found to vary greatly from one structure to another. Empirical rules governing this variation in bond length are given. (auth)

2373

THE CRYSTAL STRUCTURE OF WAl_{12}, $MoAl_{12}$ AND (Mn,Cr) Al_{12}. J. Adam and J. B. Rich (Atomic Energy Research Establishment, Harwell, Berks, England). Acta Cryst. 7, 813-16(1954) Dec.

The crystal structure of WAl_{12} has been determined from powder samples. The unit cell is body-centred cubic and a = 7.580 A. There are two WAl_{12} units per cell. The space group is T_h^5—Im3. Two W atoms are placed in special positions 0,0,0,½,½,½, and 24 Al atoms are in positions 24(g) with y = 0.184 and z = 0.309. The calculated density is 3.88 g/cm³. $MoAl_{12}$ and (Mn,Cr)Al_{12} (the G phase) are isomorphous with WAl_{12}, a = 7.573 A for $MoAl_{12}$ and a = 7.507 A for (Mn,Cr)Al_{12}. (auth)

2374

UNIT-CELL DIMENSIONS OF LITHIUM FLUORIDE MADE FROM Li^6 AND Li^7. J. Thewlis (Atomic Energy Research Establishment, Harwell, Berks, England). Acta Cryst. 8, 36-8(1955) Jan.

The unit-cell side of Li^6F and Li^7F are found to be 4.0271 ± 0.0001 and 4.0263 ± 0.0001A, respectively, at 25°C, a fractional difference of about 2×10^{-4}. It is considered that this difference arises from the difference in zero-point energy of these materials. It is to be compared with the calculated value of 3.3×10^{-4}, which is, however, in error by an unspecified amount since it applies only to temperatures above the Debye temperature. (auth)

2375

RE-INVESTIGATION OF THE CRYSTAL STRUCTURE OF CsI_3. H. A. Tasman and K. H. Boswijk (Rijks Universiteit, Bloemsingel, Groningen, Netherlands). Acta Cryst. 8, 59-60(1955) Jan.

ELECTRICAL DISCHARGE

2376

DEPARTURE FROM PASCHEN'S LAW OF BREAKDOWN IN GASES. W. S. Boyle and P. Kisliuk (Bell Telephone Labs., Inc, Murray Hill, N. J.). Phys. Rev. 97, 255-9 (1955) Jan. 15.

The failure of Paschen's law of electrical breakdown in gases at both high pressures and extremely small electrode separations is explained by a single breakdown mechanism. The breakdown field in each of these cases is sufficiently great to draw measurable field-emission current from the cathode, which produces a relatively small number of ions. The space-charge field of these ions is great enough to increase the field-emission current appreciably even when the ratio of ion current to electron current is less than one percent. As more ionic space charge is produced, each ion becomes more effective in enhancing the electron current until the breakdown condition is attained. An expression is derived for the yield of electrons per positive ion as a function of the applied field. This expression is shown to be in quantitative agreement with values of γ derived from published data on breakdown voltages at high pressures. It is shown also that the same process explains breakdown at extremely small separations below the "minimum sparking potential." (auth)

2377

BREAKDOWN PROCESSES IN NITROGEN, OXYGEN, AND MIXTURES. Elsa L. Huber (Univ. of California, Berkeley). Phys. Rev. 97, 267-74(1955) Jan. 15.

The studies of corona mechanisms in coaxial cylindrical geometry with central anode using α-particle triggering, initiated by Colli and Facchini and by Lauer in inert gases have been extended to pure nitrogen, pure oxygen, and mixtures of these gases. Pure gases were studied in a well outgassed system with nickel cathode. In pure nitrogen, from 25 to 600 mm pressure, the predominant mechanism is secondary liberation of electrons from the cathode by positive ion impact, with γ_i varying between 1.4×10^{-3} and 0.6×10^{-3}. Correction for back diffusion following Theobald gives a true γ_i of $2-3 \times 10^{-2}$. The ion is the N_4^+ observed by Varney, with reduced mobility 2.53 ± 0.08 cm²/volt sec at 760 mm and 20°C. Addition of the order of 1 percent oxygen reduces γ_i by a factor of ⅕ and gives a weak photoelectric γ_p at the cathode, both effects resulting in part from action of oxygen on the cathode as noted by Parker and Theobald. Photoionization in the gas also appears, and with 5 percent oxygen the self-sustaining corona consists to a large extent of Geiger counter-like pulses propagating along the wire. In air, there is no longer any observable cathode action at theshold. With the use of transverse and longitudinal α particle trajectories relative to the axis, the velocity of propagation of the discharge down the wire has been measured for various pressures in air, and for constant pressure and potential as a function of oxygen concentration of between 5 and 20 percent. Velocities ranged between 10^6 and 10^7 cm/sec, decreasing as oxygen concentration increased. In pure oxygen above 200-mm pressure, the absorption of photoionizing radiation is so intense that, as indicated by Miller and Loeb, instead of spreading along the wire, the discharge propagates outward in the form of radial streamers, which have a duration of less than 10^{-7} sec, contain some 10^8 ions, and are spaced at regular intervals closely related to the positive-ion transit time. The latter yields a reduced mobility of 2.2 ± 0.1 cm²/volt-sec at 760 mm Hg and 20°C, in conformity with Varney's assumed O_2^+ ion. (auth)

ELECTRONS

2378

ELECTRON OPTICAL SYSTEMS WITH RECTILINEAR AXES WITHOUT ROTATIONAL SYMMETRIES. I. I. Tsukkerman. Zhur. Tekh. Fiz. 24, 2261-3(1954) Dec. (In Russian)

2379

EXTENSION OF THE ELECTRON-OPTICAL THEORY OF DEFLECTING ELECTROSTATIC SYSTEMS TO THE CASE OF RELATIVISTIC PARTICLES. A. M. Strashkevich. Zhur. Tekh. Fiz. 24, 2264-70(1954) Dec. (In Russian)

2380

ABERRATION OF RELATIVISTIC ELECTRON BEAMS. A. M. Strashkevich and N. G. Gluzman. Zhur. Tekh. Fiz. 24, 2271-84(1954) Dec. (In Russian)

GASES

2381 CX-14

Institute of Mathematical Sciences, New York Univ.

THE COOLING OF A GAS BY RADIATION. Ernest Bauer and Ta-You Wu. Apr. 1954. 31p. Contract AF19(122)-463. (AD-40171)

A gas composed of atoms having two electronic states is considered. Transitions between these two states can take place by collisions and by emission or absorption of radiation. When the radiative transition probabilities are small compared with those due to collisions, a "temperature" may be defined for the translational motion. The general problem is formulated for the case where the total concentration of the gas depends on the space co-ordinates in a given way, and the possibility of the "imprisonment" of the radiation emitted is taken into account. In this case the problem leads to a pair of coupled integro-differential equations, from which the "temperature" and the concentration of atoms in the excited state are obtained as functions of space and time. Neglecting the resonance radiation and the spatial variation of the temperature, calculations have been made for the case when the energy difference between the two states is of the order kT, for a number of values of the ratio between radiative and collisional transition probabilities. The results are applied to the problem of the cooling of the atmospheric gas at high altitudes (100 km) at night, as a result of the magnetic dipole transitions between the components of the P^3 state of the oxygen atom. (auth)

2382 ISC-560

Ames Lab.

PURIFICATION OF THE RARE GASES. I. A COMPARISON OF ACTIVE METALS IN THE PURIFICATION OF RARE GASES. D[ale] S. Gibbs, H[arry] J. Svec, and R. E. Harrington. Dec. 30, 1954. 47p. Contract W-7405-eng-82.

Fifteen metals and alloys have been investigated to determine their relative efficacies for removing impurities from a stream of A or N_2. In the case of all the metals studied, the results demonstrated the necessity of carefully controlling the temperature and the gas flow rate through the purification chamber. Al, cast Fe, Ti, and Zn were unsatisfactory for removing both N_2 and O_2 from A at all the flow rates and temperatures investigated. Ba, Ca, Ca—10% Mg alloy, La, Mg, Th, and Zr were effective for removing O_2 from A. Brass, Cu, Ce, and U effectively removed O_2 from either A or N. Ba, Ca, Ca—10% Mg alloy, Mg, Th, and Zr satisfactorily removed N_2 from A at flow rates and temperatures listed in the tables of results. Ca, Th, and Zr were studied only in the solid state. The Ca—10% Mg alloy was an effective purifying agent only after it had melted. Ba reacted so vigorously with the impurities in the A that it melted despite a furnace temperature 350°C below its melting point. Extensive results were not obtained for either the Ca—10% Mg alloy or Ba, but the results available indicate that these metals are very effective in removing O_2 and N_2 from rare gases at relatively low temperatures. Further work with these metals employing liquid metal purifying tehcniques is warranted, although it was not a part of this study. (auth)

2383

IONIZATION OF ATOMS FOR A GAS AND OVERCHARGING OF SINGLY CHARGED IONS AT 5 TO 30 KEV ENERGIES. N. V. Fedorenko. Zhur. Tekh. Fiz. 24, 2113-23(1954) Dec. (In Russian)

Measurements of the effective cross sections for ionization and overcharging for He^+, Be^+, N^+, Ne^+, Na^+, A^+, Cu^+, Ba^+, and Pb^+ in H_2, He, Ne, N_2, A, and Kr are reported. (G.Y.)

INSTRUMENTS

2384 NP-5513

Institute for the Study of Rate Processes, Univ. of Utah

CONSTRUCTION AND OPERATION OF A ROTATING-MIRROR FRAMING CAMERA AND SYNCHRONIZER. TECHNICAL REPORT NO. XXXX. W. O. Ursenbach. Nov. 5, 1954. 14p. Contract N7-onr-45107.

A rotating-mirror framing camera has been designed and constructed for the purpose of studying detonation phenomena. This camera consists of an oil pressure-lubricated air turbine driving a rotating mirror at a maximum rate of 5000 rps with an air pressure of 126 psi. The light reflected from the mirror is focussed on 35 mm film through a bank of 24 relay lenses. This gives a maximum photographing speed of 1,200,000 frames per second. The camera is equipped with a focussing microscope, externally operated film advance controls and footage indicator, externally operated light-tight door between the focussing system and the film chamber, externally operated slits, and interlock switches. The instrument has been used successfully to photograph phenomena associated with detonation including blast contours and cone collapse in shaped charges. (auth)

2385 ORNL-1828

Oak Ridge National Lab.

A COMBINATION ISOTHERMAL-ADIBATIC LOW-TEMPERATURE CALORIMETER. R. H. Busey. Feb. 10, 1955. 30p. Contract W-7405-eng-26.

A description of a low-temperature calorimeter for the temperature range 13 to 300°K is presented. The apparatus is believed to be unique in that it may be readily operated in an isothermal or adiabatic manner. The performance of the calorimeter is demonstrated by presentation of heat capacity measurements on a Calorimetry Conference Standard Sample of benzoic acid. The data obtained agree well with the published data. The adiabatic and isothermal data are shown to agree well within the experimental error except at higher temperatures where the results by the latter procedure are slightly more erratic. (auth)

2386 WAL-401/230

Armour Research Foundation

HEAT TREATMENT OF LARGE SECTIONS OF TITANIUM ALLOYS. INTERIM TECHNICAL REPORT NO. 1. A. F. Weinberg and D. W. Levinson. Oct. 29, 1954. 11p. Contract DAI-022-ORD-(P)-5.

In order to correlate the cooling rates in Ti Jominy bars to cooling rates in large sections of Ti, an experimental apparatus capable of recording the potentials of 16 thermocouples at the rate of 5 times per second was developed. (J.E.D.)

2387 AEC-tr-2075

THE USE OF PLASTIC FOR THE PREPARATION OF DETECTORS, ABSORBERS, AND STANDARDS. (L'utilisation Du Plastic Pour La Préparation De Détecteurs, D'absorbants Et D'etalons). G. Gueben and J. Govaerts.

Translated from Bull. soc. roy. sci. Liège 22, 437-43(1953). 5p.

Results of experiments show that the use of plexiglass for making detectors, absorbers, or standards can be of valuable assistance in nuclear physics techniques. The use of detectors, absorbers, and standards requires the choice of an appropriate support and a protective cover which completely envelops the materials, thus protecting it against any deterioration. Plexiglass permits achieving this end easily, and in addition it offers the great advantage of absorbing nuclear radiations only slightly. By increasing or decreasing the amount of plexiglass it is possible to prepare pastilles of variable thickness, according to the needs of the experiment. These plexiglass pastilles, which are very strong, are resistant to any geometric modifications. They are also protected from any contamination since they are washable. The use of these pastilles eliminates all danger resulting from scattering of the radioactive material, which is a great advantage, especially in the case of radioelements with long life such as uranium. The pastilles are unbreakable and show the same resistance to chemical agents as ordinary plexiglass. (auth)

2388 AEC-tr-2076

OPERATING CONDITIONS OF A HIGH-FREQUENCY SOURCE. (Conditions De Fonctionnement D'une Source D'ions Haute Frequence). Marc de Lacoste Lareymondie, Jean Salmon, and Joseph Wajsbrum. Translated from J. phys. radium 15, 177-21(1954). 8p.

The authors describe the method by which they measured the principal variables involved in the operation of a hydrogen ion source with a discharge of 1 ma. Curves are given showing the variation of ion discharge as a function of these variables. In conclusion, data are given on focusing and atomic ion content of the beam. (auth)

2389 AEC-tr-2078

A NEW DEMOUNTABLE X-RAY DIFFRACTION TUBE: THE "CRISTABLLOBLOC." R. Griffoul. Translated from Le Vide 6, 942-50(1951). 13p.

A demountable x-ray diffraction tube has been designed to incorporate the compactness and convenience of a sealed tube and the versatility of a demountable tube. The appartus includes the x-ray tube, vacuum system, high voltage generator, and accessories in one independent unit. The dimensions of the unit are 1.075 by 0.75 by 0.90 m. A general description of the apparatus and design and performance data are presented. During several months of operation, the apparatus has proved eminently adapted to the diversity of work for which it was designed. (M.P.G.)

2390

ADIABATIC CALORIMETER FOR USE WITH CONDENSABLE GASES AND GAS–SOLID SYSTEMS BETWEEN 10 AND 150°K. E. L. Pace, Louis Pierce, and Kent S. Dennis (Western Reserve Univ., Cleveland, Ohio). Rev. Sci. Instr. 26, 20-2(1955) Jan.

A description of a low temperature adiabatic calorimeter for use in the 10 to 150°K range is given. Its construction is described in detail concerning the features in which it differs from calorimeters previously described in the literature. These features have resulted in an improved performance and precision. At 30°K, its precision was better than 0.1 percent, while at temperatures above 50°K, a precision of 0.03 percent or better is indicated. At the lowest temperatures, an uncertainty of 1 percent exists, largely the result of the decreasing sensitivity of the platinum resistance thermometer. (auth)

2391

RECORDING HIGH-SENSITIVITY PARAMAGNETIC RESONANCE SPECTROMETER. Jack M. Hirshon and George K. Fraenkel (Columbia Univ., New York). Rev. Sci. Instr. 26, 34-41(1955) Jan.

A high-sensitivity, automatic recording paramagnetic resonance absorption spectrometer operating at a wavelength of 3.2 cm is described. The spectrometer is of the crystal-heterodyne type employing a local oscillator and a magic tee bridge with a reflection cavity. Automatic frequency control of the signal and local-oscillator klystrons is provided to eliminate anomalous dispersion and to reduce frequency fluctuations. The output signal can be presented as a trace of the paramagnetic absorption versus magnetic field on a continuous strip recorder, as a pattern on an oscilloscope of absorption versus magnetic field for either visual observation or photographic recording, or as a continous recorder trace of the derivative of absorption versus magnetic field. Provision is made for calibration of the magnetic field by means of the proton magnetic resonance absorption. Approximately 2×10^{-11} mole of 1,1-diphenyl-2-picryl hydrazyl can be detected with the spectrometer. (auth)

2392

BOOSTER CRYOSTAT FOR TEMPERATURES DOWN TO 0.74°K. K. R. Atkins, M. H. Edwards, and G. T. Pullan (Univ. of Toronto, Canada). Rev. Sci. Instr. 26, 49-50(1955) Jan.

The cryostat produces temperatures down to 0.74°K by pumping on a liquid helium bath with a large diffusion pump. A shielding pot containing liquid helium at 2°K reduces heat influxes to the main bath and plays a very important role in reducing the pressure drop arising from viscous flow of the gas up the helium Dewar. The low temperature region is visible and the experimental apparatus is easily accessible merely by removing two glass Dewars. (auth)

2393

RECORDING INTEGRATING PHOTOELECTRIC AND RADIOACTIVE SCANNER FOR PAPER ELECTROPHORESIS AND CHROMATOGRAPHY. E. L. Durrum and S. R. Gilford (Walter Reed Army Medical Center, Washington, D. C. and National Bureau of Standards, Washington, D. C.). Rev. Sci. Instr. 26, 51-6(1955) Jan.

A versatile automatic scanner for paper strips which records directly optical density or radioactivity is built around a servo type recorder (Brown). Interference filters provide a narrow band light source. For scanning in the visible or ultraviolet where monochromatic light is desired the monochromator of a Beckman model DU spectrophotometer replaces the filters. The instrument incorporates positive synchronization of strip and recording paper, sequential scanning of strips to provide an optical density curve followed by superposition of the integral of this curve. Areas are easily calculated without the need for planimetry. The slits of varying size are interchangable and are designed for either optical or radioactive scanning. For medium levels of activity a Geiger-Müller tube is interchangable with the photocell, while for low activities, optical scanning of autoradiographs may be performed. (auth)

2394

PRELIMINARY REPORT ON A "ZIPPER" SCATTERING

CHAMBER. Charles J. Cook (Univ. of Nebraska, Lincoln). Rev. Sci. Instr. 26, 92-3(1955) Jan.

The chamber described allows investigation of a scattered beam at any angle from 0 to 160° with the scattered and incident beam lying in a horizontal plane. (auth)

2395

A HIGH-RESOLUTION EVAPORATED-CARBON REPLICA TECHNIQUE FOR THE ELECTRON MICROSCOPE. D. E. Bradley (Associated Electrical Industries, Ltd., Aldermaston, Berks, England). J. Inst. Metals 83, 35-8(1954) Sept.

A simple two-stage replica technique, using an intermediate dry-stripped Formvar film and evaporated carbon as the final replica, is described. The carbon film, though very thin, is much more easily seen during the preparation than an equivalent silica film; largely because of this, the preparation time is short and results are consistent. The final resolution is better than 50 A. It is demonstrated that, contrary to previous belief, the Formvar film replicates the surface topography with a resolution of a few tens of A. Even with very deeply etched specimens, results which are clear and easy to interpret are obtained. (auth)

2396

A MEASURING APPARATUS EMPLOYING A REFERENCE LINE OF VARIABLE BRIGHTNESS. C. S. Lees (Atomic Energy Research Establishment, Harwell, Berks, England). J. Sci. Instr. 32, 17-18(1955) Jan.

An improvement on the normal traveling microscope arrangement is described for measurement of electron or x-ray diffraction films. The new apparatus used as a reference line the image of an illuminated glass fiber of adjustable brightness. (auth)

2397

AN APPARATUS GIVING AN α-PARTICLE MICROBEAM FOR THE IRRADIATION OF LIVING CELLS. H. A. B. Simons (Univ. of London, England). J. Sci. Instr. 32, 21-4 (1955) Jan.

A microscope fitted for phase contrast observation is modified so that a biological specimen in the center of the field of view may be irradiated with α particles. A beam of α particles is obtained from a polonium source by a glass capillary collimating tube of 15 μ internal diameter, the sourve and collimator being mounted in a tube passing axially through the optical condenser. The irradiation rate is of the order of 1 particle/min, and 70% of the particles lie within a circle of 30 μ diameter in the focal plane of the objective. A statistical method is used to calculate the probability of irradiation of a target of known size which is irradiated for a known time. (auth)

2398

AN ADJUSTABLE BILATERAL SLIT FOR USE WITH A PHOTOMULTIPLIER IN A SOFT X-RAY SPECTROMETER. P. Fisher (Univ. of Western Australia). J. Sci. Instr. 32, 32-3(1955) Jan.

ISOTOPES

2399 MLM-938

Mound Lab.

PREPARATION OF CARRIER-FREE YTTRIUM-90. (INFORMATION REPORT). M[urrell] L. Salutsky and H. W. Kirby. Feb. 12, 1954. 10p. Contract AT-33-1-GEN-53.

A rapid method is described for obtaining a continual supply of carrier-free Y^{90} (64-hour half-life) from its long-lived parent Sn^{90} (19.9-year half-life). In the recommended procedure the Sn^{90} is purified and after Y^{90} grows in the Sn^{90} is precipitated with strontium nitrate carrier from 80 per cent nitric acid. Y^{90} is recovered from the filtrate. The strontium nitrate is saved for preparation of other quantities of Y^{90}. A yield of about 95 per cent was obtained, and a high purity was indicated by the fact that the Y^{90} decayed with a 64-hour half life for about 26 days. By use of this method a continual supply of Y^{90} is available when needed for an indefinite period of time. (auth)

2400

EVIDENCE FOR A SECOND NATURALLY OCCURRING ISOTOPE IN TANTALUM. John E. Evans, E. G. Joki, and R. R. Smith (Phillips Petroleum Co., Idaho Falls, Idaho). Phys. Rev. 97, 565-6(1955) Jan. 15.

Strong evidence for a second naturally occurring Ta isotope of atomic mass 181 ± 2 was obtained from a small "resonance shaped" peak observed with the MTR crystal spectrometer at 0.433 ± 0.004 ev during high-resolution neutron total cross section measurements on a >99.9% pure Ta metal sample. (L.M.T.)

2401

NEW NATURALLY OCCURRING ISOTOPE OF TANTALUM. F. A. White, T. L. Collins, Jr., and F. M. Rourke (Knolls Atomic Power Lab., Schenectady, N. Y.). Phys. Rev. 97, 566-7(1955) Jan. 15.

From careful examination of the mass spectrum of Ta in the Ta^{181} region, Ta^{180} is, found to exist as a naturally occurring isotope with an abundance of 0.0123 ± 0.0003%. (L.M.T.)

2402

PRODUCTION OF ENRICHED NON-RADIOACTIVE ISOTOPES AT OAK RIDGE NATIONAL LABORATORY. C. P. Keim (Oak Ridge National Lab., Tenn.). Nature 175, 98-101 (1955) Jan. 15.

2403

PRODUCTION OF ELECTROMAGNETICALLY ENRICHED STABLE ISOTOPES AT HARWELL. W. D. Allen, R. H. Dawton, M. L. Smith, and P. C. Thonemann (Atomic Energy Research Establishment, Harwell, Berks, England). Nature 175, 101-3(1955) Jan. 15.

ISOTOPE SEPARATION

2404 AECD-3642

Oak Ridge National Lab., Y-12 Area

CONCENTRATION OF THE STABLE ISOTOPES OF CHROMIUM BY THE ELECTROMAGNETIC PROCESS. C. V. Ketron, W. A. Bell, and L. O. Love. Mar. 7, 1951. Decl. with deletions Nov. 18, 1954. 22p. Contract W-7405-eng-26.

The inventory of chromium samples enriched in isotopic abundance has been replenished. Calutron components used in processing the material, operating characteristics of the charge, and production rates are presented. The laboratories using chromium isotopes are listed in an appendix. (auth)

2405 CRCE-501

Chalk River Project (Canada)

THE SOLUBILITY ISOTHERM OF HYDROGEN IN WATER AT 217°C AND PARTIAL PRESSURES OF HYDROGEN FROM 0 TO 1065 P.S.I.A. T. W. Barry. Feb. 29, 1952. 18p. (AECL-117)

Hydrogen gas was dissolved in water at 217°C over a range of partial pressures of hydrogen from 0 to 1065 psia. This was accomplished by charging hydrogen and water into a stainless steel pressure vessel and allowing them to come to equilibrium in a constant temperature bath. The pressure vessel was so designed that the liquid phase could be isolated after equilibrium had been reached. The volume of gas dissolved in the water was then determined by expelling it into a calibrated expansion train. Samples of this gas were analyzed in a mass spectrometer to determine whether the hydrogen had been enriched in deuterium. An enrichment factor of 2.0 was found at several partial pressures of hydrogen. The solubility isotherm is linear and passes through the origin. Since the enrichment factor is small and the equipment cumbersome a plant designed to separate hydrogen and deuterium using the above principle would probably not be economically feasible. (auth)

2406 Y-779

Oak Ridge National Lab., Y-12 Area

THE ELECTROMAGNETIC CONCENTRATION OF THE STABLE ISOTOPES OF INDIUM. W. A. Bell and L. O. Love. June 18, 1951. Decl. Nov. 18, 1954. 18p. Contract W-7405-eng-26.

Indium was processed in the α calutron using beta M12 source units with InI_3 and InI charges to produce material enriched in a certain isotope. Ion reception for 656 hr resulted in the collection of 42.95g of In^{115} and 2.37g of In^{113}. The use of InI as a charge material resulted in higher production rates. Equipment components, operation, and output are discussed in detail. (J.A.G.)

MASS SPECTROGRAPHY

2407

A PANORAMIC MASS SPECTROSCOPE FOR KINETIC STUDIES. Edouard G. Leger (Laval Univ., Quebec, Canada). Can. J. Phys. 33, 74-95(1955) Feb.

A mass spectroscope capable of recording the trend of many chemical species in rapid gas-phase reactions is described. The instrument represents a departure from analytical mass spectrometric practice by using a molecular steaming source, rapid electric scanning, an electron multiplier ion detector amplifier, and a cathode ray tube display. A 40 peak spectrum can be scanned in five milliseconds and recorded by a motion picture camera. A few results obtained with this instrument in the study of diethyl ether cool flames are given. (auth)

2408

A TRAP-CURRENT CONTROLLED EMISSION REGULATOR FOR A MASS SPECTROMETER ION-SOURCE. D. Greenhalgh and P. M. Jeffery (Univ. of Western Australia). J. Sci. Instr. 32, 36-7(1955) Jan.

MATHEMATICS

2409 RPR-128

Radiophysics Lab., Univ. Grounds, Sydney (Australia)

ELECTRONIC COMPUTER TEST AND MONITOR EQUIPMENT. R. D. Ryan. Apr. 1954. 29p.

Test and monitoring equipment used for checking the operation of the C.S.I.R.O. Electronic Computer are described. These include four similar test racks used for checking the waveforms, voltages, etc in the various computer units, and computer monitor unit for monitoring the contents of the different memory lines, arithmetic registers during the progress of a computation, and finally a console monitor which also displays the contents of the memory and the D register. (auth)

2410 RPR-129

Radiophysics Lab., Univ. Grounds, Sydney (Australia)

MERCURY DELAY LINE MEMORY C.S.I.R.O. COMPUTER. R. D. Ryan. June 1954. 28p.

The memory unit of the CSIRO Electronic Digital Computer was modified by the addition of Hg delay lines, and a change in the gating circuits associated with the input and output to the memory. The system effectively doubles the storage capacity of the memory. (K.S.)

2411 UCRL-2783

Radiation Lab., Univ. of Calif., Berkeley

LEAST-SQUARES FITTING OF A GAUSSIAN FUNCTION AND EVALUATION OF THE ERRORS OF THE COEFFICIENTS. Richard Mitchell and Richard Madey. June 1, 195[4]. 23p. Contract W-7405-eng-48.

In order to represent a set of observational points $(R_i, 1_i)$ by the Gaussian function $R = R_0 \exp [-(1-1_0)^2/2\beta^2]$, the arbitrary constants R_0 and β must be evaluated. The least-squares method for determining the best values for the constants is described. The least-squares criterion is transformed to an equivalent criterion in which the constants appear linearly. The linear criterion is differentiated and equated to 0. This provides 2 linear equations in the constants which are easily solved by determinants. The standard deviations of the values obtained for the arbitrary constants are estimated. (M.P.G.)

MEASURING INSTRUMENTS AND TECHNIQUES

2412 AD-19590

Wisconsin Univ.

THE LITHIUM FLUORIDE THERMOLUMINESCENT DOSIMETER. PROGRESS REPORT NO. 4. Farrington Daniels and William P. Riemen. July 1, 1953. 11p. Contract DA18-108-CML-3069.

2413 BNL-2140

Pennsylvania State Univ.

MODIFICATION OF GENERAL ELECTRIC SPG. GONIOMETER FOR SINGLE-CRYSTAL NEUTRON DIFFRACTION MEASUREMENTS. R[ay] Pwpinaky, Pennsylvania State Univ. and B. C. Frazer, Brookhaven National Lab. [Dec. 24, 1954]. 5p. Contract AT(30-1)-1516.

A commercially available x-ray spectrogoniometer has been modified for neutron diffraction measurements. The specimen holder, incident slit system, and Geiger-counter mount have been removed. A circle is mounted on the specimen-holder table which can be rotated by means of a worm gear and positioned to within 0.5 min of arc. A standard x-ray goniometer head is mounted at the center of the circle. The x-ray counter has been replaced by a miniaturized BF_3 neutron counter which can be adjusted to any elevation angle from -20° to 90°. A 2-rpm motor permits continuous scanning with the counter at a rate of 0.8° per hr. The incident beam slit is mounted in the shield which encloses the monochromatizing crystal. (M.P.G.)

2414 CERN-BS-16

European [Council] for Nuclear Research

MEASUREMENT OF IONIZATION. Michele Della Corte. Dec. 15, 1954. 3p.

A method for determining the ionization of a track by measuring the average gap length between exposed grain groups has been developed and successfully tested. A microscope is used whose equipment allows the track to be set parallel to the forward movement of the stage. Only gaps are measured whose length exceeds a selected minimum value. Gaps are measured by moving the hair line of the micrometer eyepiece, while grains are measured by moving the track by means of the microscope stage micrometer. The total length of the gaps is thereby summed on the micrometer eyepiece drum, and the total length of the grains is summed on the microscope stage micrometer screw. This technique may be modified by using a double drum micrometer. (M.P.G.)

2415 FWE-31

Atomic Energy Research Establishment, Harwell, Berks (England)

RECENT TRENDS IN BRITISH RADIAC INSTRUMENTATION. Denis Taylor and W. Abson. Oct. 1954. 30p.

Radiac instruments developed for the Armed Services and Civil Defense fall into two main classes—dose and dose-rate meters. Broad specifications are given and instruments already developed are described. Some new techniques and components are described. In particular, the use of spring-driven generators in place of batteries is suggested. An ionization chamber instrument using a two-valve negative feedback amplifier could be used for the entire range required by the contamination and survey meter specifications and this is discussed. The paper ends with a discussion of training problems. (auth)

2416 UCRL-1880

Radiation Lab., Univ. of Calif., Berkeley

A FAST COUNTING SYSTEM FOR HIGH-ENERGY PARTICLE MEASUREMENTS. Richard Madey. Oct. 1954. 62p. Contract W-7405-eng-48.

A fast coincidence counting system for high-energy particle measurements combines a scintillation counter pulse-shaping circuit and a crystal diode coincidence circuit. The system is simple and reliable. Both the resolution time of the system and the double pulse separation time of the individual counters can be as short as three millimicroseconds, with essentially one hundred percent detection efficiency. (auth)

2417

DETECTION OF THERMAL NEUTRONS BY BORAZOLE FILLED PROPORTIONAL COUNTERS. H. C. Hamers, J. Blok, and C. C. Jonker (Natuurkundig Laboratorium, Amsterdam, Netherlands) and A. E. de Vries, H. Jansz, and J. Kistemaker (Laboratorium voor Massaspectrografie, Amsterdam, Netherlands). Physica 20, 1138-40(1954) Nov. (In English).

The counting properties of borazole ($B_3N_3H_6$) are compared with those of BF_3 by comparison of identical counter tubes filled with $B_3N_3H_6$ and BF_3. The ratio of the efficiencies was determined to be 3 ± 0.5, which agrees with the value 3 suggested by the ratio of the B contents in both gases. The maximal pulse height in BF_3 is about 4 times larger than in $B_3N_3H_6$ for equal voltage and pressure. The gas amplification factor in BF_3 is 5.1 times larger than in $B_3N_3H_6$ at 978 ν. The preparation of $B_3N_3H_6$ is described. The stability of the gas permits its use for some months if the neutron flux is small, but there are some indications that the gas amplification factor increases and the efficiency decreases during this time. (M.P.G.)

2418

APPARATUS FOR REDUCING THE RESOLVING TIME OF ELECTRONIC PULSE DIVIDERS. R. Favre. Helv. Phys. Acta 27, 683-9(1954) Dec. (In French)

A procedure and several circuits are described which provide for a considerable reduction in the recording error of an electronic divider with a relatively high resolving time, used in the statistical counting of pulses. Error curves are given for different cases, and several particular applications are suggested. (tr-auth)

2419

A SELF-BALANCING DEVICE FOR THE MEASUREMENT OF IONIZATION CURRENT RATIOS. G. A. Mauchel, E. R. Epp, and H. E. Johns (Univ. of Saskatchewan and Saskatoon Cancer Clinic, Canada). Brit. J. Radiol. 28, 50-3(1955) Jan.

A device is described which measures the ratio of two instantaneous dosage rates. The device consists of two dc amplifiers coupled in such a way that a fraction of one's output is balanced against the total output of the other. The balance is continuously maintained by a servo mechanism so that the instrument indicates on a dial the ratio at all times. Raytheon electrometer pentodes simplify the construction of the dc amplifiers. By a simple switch the device may be converted into a straight dc amplifier. (C.H.)

2420

A SCALER FOR THE MEASUREMENT OF HALF-LIVES IN THE RANGE THREE SECONDS TO THIRTY MINUTES. J. L. W. Churchill and W. W. Evans. Electronic Eng. 27, 74-7(1955) Feb.

New determinations have been made of the half lives of the positron emitters Al^{25}, Al^{26}, and N^{13} and the results of these have been reported previously. The equipment used to make these measurements is novel in that it employs the comparatively new cold cathode decade counting tubes known as "Dekatrons". The method employed is to count the number of disintegrations of the sample occurring in successive equal intervals of time and the Dekatron tubes offer a simple and economical method of providing a number of scaling units and a timing device. (auth)

2421

A METHOD OF ESTIMATING DISTORTION IN CLOUD CHAMBER TRACKS. N. Cusack and P. Stott (Univ. of London, England). J. Sci. Instr. 32, 34(1955) Jan.

A method suited to a horizontal chamber not designed for counter control is proposed. Each photograph was taken by the light of two separate flashes, a timed interval apart. Track movements due to gas motion caused doubling of the track images, elongation of the background droplets, and similar phenomena, and by measuring the displacement of tracks in the known time, the velocity of the currents producing distortion was estimated. The distance measurements were made on the film with a microscope and calibrated eyepiece scale. (L.T.W.)

2422

OBSERVATION OF HIGH ENERGY PARTICLE TRACKS INTENSIFIED BY USE OF A PROPANE BUBBLE CHAMBER. G. A. Blinov, Yu. S. Krestnikov, and I. I. Pershin. Doklady Akad. Nauk S.S.S.R. 99, 929-30(1954) Dec. 21. (In Russian)

Electron tracks from Co^{60} γ irradiation, a 660 Mev proton track, and stars produced by 600 Mev neutrons are illustrated as observed in a propane-filled bubble chamber. (G.Y.)

2423

CORONA THRESHOLD AND THE RANGE OF VELOCITIES OF PULSE SPREAD IN GEIGER COUNTERS. Leonard B. Loeb (Univ. of California, Berkeley). Phys. Rev. 97, 275-7(1955) Jan. 15.

By using the writer's expression for a self-sustaining burst pulse corona and Alder, Baldinger, Huber, and Metzger's expression for the propagation of a Geiger pulse along the anode wire in coaxial cylindrical counter geometry, the limits of the velocity of spread of counter pulses can clearly be delineated. The interpretations resulting clarify the significance of the previously assumed fictive average distance of spread. These relations are illustrated in terms of the observations of E. Huber on O_2-N_2 mixtures. (auth)

2424

PHOTOSTIMULATED EMISSION OF SOME ACTIVATED ALKALI HALIDE PHOSPHORS. C. E. Mandeville and H. O. Albrecht (Franklin Inst., Swarthmore, Penna.) Phys. Rev. 97, 347-51(1955) Jan. 15.

The intensity of the photostimulated ultraviolet emission of x-ray excited phosphors of NaCl—Tl, KCl—Tl, NaCl—Ag, and KCl—Ag has been measured as a function of the wavelength of the incident light. The results indicate that, in the first thirty days following excitation at least, F centers are primarily responsible for the storage of energy. Thus, the storage properties depend upon the nature of the host material, rather than upon the intentionally added activator. Evidence is also presented which seems to indicate the presence of a deep trap associated with the silver ions of KCl—Ag which has a period of decay comparable to that of the F centers. Excitation, storage, and all measurements were carried out at 22°C. Polycrystalline materials, prepared by the writers, were used throughout the investigation. (auth)

2425

CHARACTERISTICS OF BUBBLE CHAMBERS. Donald A. Glaser and David C. Rahm (Univ. of Michigan, Ann Arbor). Phys. Rev. 97, 474-9(1955) Jan. 15.

The bubble chamber is a new radiation detector in which ionizing events produce tracks consisting of strings of tiny bubbles in a superheated liquid. By means of fast flash photography, practically distortionless bubble tracks can be recorded for the study of high-energy nuclear events. A chamber six inches long has been constructed and chambers several feet long seem feasible, so the bubble chamber can have both high stopping power and large size. Liquids containing only elements of low atomic number can be used to minimize Coulomb scattering so that accurate magnetic curvature measurements can be made. Tracks of minimum ionizing particles contain up to 100 bubbles per centimeter, and the bubble density varies with ionization density, thus making bubble counting a possible method for measuring ionization. The short sensitive and resetting times of bubble chambers tend to reduce background radiation problems and increase data collection rates for experiments with pulsed accelerators. Unfortunately the lifetime of the bubble nuclei seems to be too short to permit counter-controlled expansion after the passage of the particle to produce tracks. Therefore it is unlikely that the types of bubble chambers described here will be useful for cosmic-ray experiments. (auth)

2426

DECAY TIMES OF SOME ORGANIC SCINTILLATORS. R. K. Swank and W. L. Buck (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 26, 15-16(1955) Jan.

The luminescence decay times of a number of organic crystal liquid, and plastic scintillators are reported. The scintillators were excited by pulses of x radiation of 7.5-kev quantum energy. The dimensions of the specimens are given, although the effect of specimen size on decay time was not investigated. (auth)

2427

GEOMETRIC EFFICIENCY OF CYLINDRICAL COUNTERS. José Goldemberg (Univ. of Sao Paulo, Brazil). Rev. Sci. Instr. 26, 41-4(1955) Jan.

Counting experiments were made with cylindrical counters fitted with geometry "definers" in order to ascertain whether it is possible to find an area of constant sensitivity in these counters. These measurements are similar to those made by Gleason et al. with end-window counters. It is possible to achieve this result by means of a careful choice of the dimensions of these definers. The definers also allow a great simplification of the calculation of counter efficiency for a point source. A formula is presented for sources placed in any position with respect to the counter. This formula is compared with experiment, and the agreement is found to be good. A comparison of absolute beta counting between one of the cylindrical counters (with definer) and an end-window counter (with definer) is made. The agreement obtained is satisfactory. (auth)

2428

PHOTOGRAPHIC DOSIMETRY OF X- AND GAMMA RAYS. Margarete Ehrlich. Natl. Bur. Standards (U. S.) Handbook 57, Aug. 20, 1954. 28p. $0.15 (GPO)

This handbook contains primary factual data and basic principles necessary for photographic dosimetry of x and γ radiation. Most of the information presented is concerned with the use of commercial photographic film. (C. H.)

2429

GAMMA COUNTING OF RADIOSODIUM AND RADIOPOTASSIUM IN THE BIOASSAY OF ALDOSTERONE AND RELATED STEROIDS. Alan L. Orvis and A. Albert (Mayo Clinic, Rochester, Minnesota). Endocrinology 56, 218-20 (1955) Feb.

A method is described for the simultaneous determination of radioactive sodium and potassium in urine by gamma ray counting. The application of this physical method of determination of Na^{24} and K^{42} to the assay of adrenal steroids effective in mineral metabolism is illustrated. The advantages of gamma ray counting over beta ray counting are ease, convenience and rapidity of performing the determinations, and versatility for application to in vivo problems. (auth)

2430

MICROINTERFEROMETRIC EXAMINATION OF NUCLEAR EMULSION PLATES. B. S. Thornton (C.S.I.R.O., Sydney, Australia). Australian J. Phys. 7, 652-4(1954) Dec.

Examination of particle tracks in nuclear emulsion plates has been performed by interferometry. The depths of tracks in an emulsion are clearly revealed by this method. Only tracks near the surface can be examined unless the emulsion is stripped from the glass. Interferometry may help to distinguish between different types of particles, especially those of high ionizing power. Interference

techniques combined with grain-gradation development should make it possible simultaneously to differentiate between particles and to provide the range-energy curve. (M.P.G.)

2431

INSTRUMENTS IN PROSPECTING AND ANALYZING RADIOACTIVE MINERALS. D. J. Stern. Precambrian 26, No. 4, 17-21(1953) Apr.

2432

COMPARISON OF RADIOACTIVITIES BY THE USE OF X-RAY FILM. A. N. Davenport and G. W. W. Stevens (Kodak Research Lab., Wealdstone, Harrow, Middesex, England). Brit. J. Appl. Phys. 6, 31-4(1955) Jan.

A direct comparison has been made of the use of a counter and of autoradiography as alternative methods for measuring relative radioactivity. The silver contents of a number of uniform photographic images were determined analytically, and portions of these images were quantitatively converted to silver iodide in the presence of I^{131}. The resultant sources were compared both with a counter and by autoradiography, the sources being placed against different areas of a sheet of x-ray film for a series of times. When the activities were assessed by measuring the densities of the processed film, the results agreed with the analytical data as well as did those obtained with the counter. Even visual density matching afforded accuracy adequate for many tracer experiments. Circumstances in which autoradiography may be preferable to the use of a counter are also discussed. (auth)

MESONS

2433 CERN/T/JH-1

European Council for Nuclear Research

SUMMARY OF THE EVIDENCE OF HEAVY MESONS. John E. Hooper. Mar. 1953. 24p.

2434

CHARGED PHOTOMESONS FROM CARBON. David Luckey (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 97, 469-70(1955) Jan. 15.

Cross sections per Mev meson energy per equivalent quantum for the production of π^+ mesons from carbon by 310-Mev bremsstrahlung have been measured in the angular range from 30° to 180°. Carbon data exist for those meson energies and angles which correspond to π^+ production from free protons by γ rays of 200, 235, and 265 Mev. A comparison is made to production from hydrogen by giving the efficiency ϵ, defined as the ratio of production per proton in carbon to that in hydrogen. Various π^-/π^+ ratios are given for carbon. (auth)

2435

RADIATIVE CORRECTIONS TO MUON DECAY. R. J. Finkelstein and R. E. Behrends (Univ. of California, Los Angeles). Phys. Rev. 97, 568-70(1955) Jan. 15.

Electromagnetic corrections to the spectrum of the muon are given for three typical interactions (S + aP, S + aT + bP, S + aA + bP, where a = ±1 and b = ±1 in charge retention order). (auth)

2436

MEAN LIFE OF DECAY OF MUONS IN THE ABSENCE OF MATTER. N. N. Biswas (Rose Inst., Calcutta, India). Indian J. Phys. 28, 431-6(1954) Sept.

The possibility of a slow decrease of the mean life of positive muons with the decrease of Z, as seen from some accurate experiments has been utilized to infer that the mean life of free decay of the negatives (in the absence of matter) is about 2.35 μ sec, which is higher than the mean life of the positives (2.22 μsec), if the positives are assumed to undergo free decay in the presence of matter. It is argued that the variation of τ_+ with Z, if true, may either be due to the deceleration of the positives by the Coulomb field or the capture of the positives as the Coulomb barrier decreases. The latter process is thought to be more likely. (auth)

MOLECULAR PROPERTIES

2437 UCRL-2832

Radiation Lab., Univ. of Calif., Berkeley

THE DISSOCIATION ENERGIES OF SOME COMMON MOLECULES. Leo Brewer. Jan. 1955. 4p. Contract W-7405-eng-48.

The most recent values for the dissociation energies of 18 gaseous compounds have been tabulated. The energies are for the complete dissociation of the molecule to monatomic gaseous species in their ground electron state. (M.P.G.)

2438

CALCULATION OF ENERGY LEVELS FOR INTERNAL TORSION AND OVER-ALL ROTATION. I. CH_3BF_2 TYPE MOLECULES. E. Bright Wilson, Jr., Chun Chia Lin, and David R. Lide, Jr. (Harvard Univ, Cambridge, Mass.). J. Chem. Phys. 23, 136-42(1955) Jan.

Methods are described for calculating the energy levels for the over-all rotation and internal torsion of molecules consisting of a rigid symmetrical top attached to a rigid asymmetrical framework in such a way that the symmetry axis of the top coincides with a principal axis of the molecule. Probable examples are nitromethane and CH_3BF_2. Matrix perturbation methods are employed to obtain finite rotational secular equations valid in each of the cases: low barrier, high barrier, low asymmetry. These secular equations are modifications of the ordinary Wang equation for the rigid asymmetric rotor and can usually be solved by the continued fraction method. The symmetry groups applicable to this problem are also discussed. (auth)

2439

ANALYSIS OF ORTHO- AND PARA-HYDROGEN MIXTURES BY THE THERMAL CONDUCTIVITY METHOD. A. T. Stewart and G. L. Squires (Cavendish Lab., Cambridge, England). J. Sci. Instr. 32, 26-9(1955) Jan.

The thermal conductivity method of measuring the proportion of ortho in para molecules in a sample of hydrogen has been developed, and an accuracy of about 0.1% in the measurements has been attained. A description of the method is given. (auth)

NEUTRONS

2440

NEUTRON OPTICS. D. J. Hughes. Interscience Tracts on Physics and Astronomy, No. 1. R. E. Marshak, ed. New York, Interscience Publishers, Inc., 1954. 136p.

Basic physical principles and applications of neutron optics are treated in relation to information which may be obtained on the structure of matter and the measurement of fundamental nuclear constants. A sufficient amount of nuclear and collision theory is used to provide a fundamental understanding of important phenomena, but detailed nuclear

interaction theory is avoided. In addition to specific chapters on neutron scattering and applications to nuclear interactions, magnetic properties, and the structure of matter, separate consideration is given to the general features and methods of experimental techniques. (K.S.)

NUCLEAR PROPERTIES

2441

ENERGY LEVELS IN Ca^{42} AND Ca^{44}. John P. Schiffer (Yale Univ., New Haven, Conn.). Phys. Rev. 97, 428-31 (1955) Jan. 15.

The $K^{39}(\alpha,p)Ca^{42}$, $K^{41}(\alpha,p)Ca^{44}$, and $Ca^{43}(d,p)Ca^{44}$ reactions were studied and ground state Q values of − 0.19, 0.98, and 9.07 Mev respectively were found. Energy levels in Ca^{42} were found at 1.51, 1.95, 2.29, 2.59, and 3.02 Mev and in Ca^{44} at 1.13, 1.92, 2.28, 2.58, 2.97, and 3.17 Mev. An anomalously low cross section was observed for the $Ca^{43}(d,p)Ca^{44}$ reaction. (auth)

2442

ENERGY OF THE GROUND STATE OF Li^6. J. Irving and D. S. Schonland (Univ. of Southampton, England). Phys. Rev. 97, 446-50(1955) Jan. 15.

The binding energy of Li^6 is calculated by using a wave function of the exponential type with a central Yukawa interaction, both neutral and symmetric exchange characters being considered. The neutral interaction leads to a large excess binding energy whereas the symmetric case gives much too small a value, for a particular set of nuclear parameters. The contribution to the energy from the central part of the neutral and symmetric types of Pease-Feshback interaction is also determined. (auth)

2443

INELASTIC COLLISION CROSS SECTIONS AT 1.0-, AND 4.5-MEV NEUTRON ENERGIES. J. R. Beyster, R. L. Henkel, and R. A. Nobles (Los Alamos Scientific Lab., New Mexico). Phys. Rev. 97, 563-4(1955) Jan 15.

Inelastic collision cross sections at the above energies were determined by sphere transmission measurements for Be, C, Al, Ti, Fe, Ni, Cu, Zn, Zr, Ag, Cd, Sn, W, Au, Pb, and Bi. (L. M. T.)

2444

NEW EXPERIMENTAL EVIDENCE ON THE EXISTENCE OF INSTANTANEOUS SUB-SHELLS IN THE LIGHT NUCLEI OF THE PHOTOGRAPHIC EMULSION FOR ENERGETIC NUCLEONS. Pierre Cüer, Jean Combe, and Adham Samman. Compt. rend. 240, 75-7(1955) Jan. 3. (In French).

The scattering of 340-Mev protons in the light transparent nuclei of an emulsion indicates an important part of the elastic scattering is due to p subshells. Primary p-α collisions are identified in detail in many cases for C^{12}. It is shown numerically that the results of Strauch and Titus at 93 Mev are not due to the existence of excited states in C^{12}, but to subshells which can be detected quantitatively by this method. (tr-auth)

NUCLEAR REACTORS

2445 AERE-RP/M-46

Atomic Energy Research Establishment, Harwell, Berks (England)

THE VARIATION OF NEUTRON FLUX WITH NUMBER OF FUEL ELEMENTS IN THE APPROACH TO CRITICALITY OF ZEPHYR. J. J. Syrett. Aug. 16, 1954. 8p.

An expression is derived by diffusion theory for the neutron flux in a subcritical reactor consisting of a reflected cylindrical core containing a neutron source. By applying this expression to a model of Zephyr, it is shown numerically that for a fixed source at the center of the core, the square root of the number of fuel elements in the core divided by the neutron flux at a fixed point in the reflector, plotted as a function of the number of fuel elements, is approximately a straight line when more than half the critical number of fuel elements are present. The results are compared with those obtained during the approach to criticality of Zephyr. (auth)

2446 IDO-16073

Phillips Petroleum Co. Atomic Energy Div.

A SURVEY OF THE MATERIALS TESTING REACTOR SHIELD. E. Fast, J. P. Byrom, and J. W. McCaslin. May 27, 1953. Decl. Oct. 11, 1954. 38p. Contract AT(10-1)-205.

A detailed survey of the Materials Testing Reactor shield to determine its adequacy from a health physics point of view has been completed. The survey was made with x-ray film and with survey instruments. The bulk shield in general shows no radiation leaks attributable to faulty construction. However, beam intensities from the experimental plugs are greater than anticipated. Revisions were made in the keys for orienting the experimental plugs, and in the outer shielding plugs to reduce these beam intensities to permissible values. No excess neutron intensities were found except at the thermal column. The slow neutron flux was originally at biological maximum permissible during full power operation, but one-fourth inch of boral plate has effectively reduced this by a factor of roughly 10^3. Gamma intensities at this point remain at near maximum permissible levels (MPL=7.5 mr/hr). The shield of the sub-pile room appears to be considerably better than the designers anticipated. A maximum intensity of 300 mr/hr was measured in the basement during the discharge of a fuel assembly through the sub-pile room. During normal operation a reading of 1 to 2 mr/hr is observed in general in the sub-pile room. (auth)

2447 NDA-10-96

Nuclear Development Associates, Inc.

A MULTIGROUP APPROXIMATION TO THE BOLTZMANN EQUATION FOR CRITICAL REACTORS. E. Greuling, F. Clark, and G[erald] Goertzel. [nd] 28p. Work performed under subcontract with Pratt and Whitney Aircraft Div.

A multigroup technique has been formulated for application to criticality and related computations. The method is applicable to hydrogen as well as heavier moderator assemblies. To adapt the system to regions of varying composition a method of spacial integration was chosen which does not depend heavily on average values over a region and which permits a varying spacial increment in integration. (M.P.G.)

2448

NUCLEAR REACTORS FOR RESEARCH. Manson Benedict (Massachusetts Inst. of Tech., Cambridge). Chem. Eng. Progr. 51, 53F-66F(1955) Feb.

A brief discussion of research reactor operating principles is given together with a survey of reactor uses, the types available, their cost, and safety problems. (K.S.)

NUCLEAR TRANSFORMATION

2449

EXPERIMENTS ON THE DIRECT PHOTONUCLEAR EF-

FECT. Sven A. E. Johansson (Iowa State Coll., Ames). Phys. Rev. 97, 434-43(1955) Jan. 15.

An investigation has been made of the high-energy protons and neutrons emitted in irradiation with bremsstrahlung of 65-Mev maximum energy. Protons above 14 Mev were measured. The energy limit for the neutrons varied. The angular distributions of protons from carbon, aluminum, nickel, and molybdenum could be fitted with curves of the form $a+(\sin\theta+b\sin\theta\cos\theta)^2$ with the maximum around 60°. The angular distributions of neutrons above 5 and 10 Mev could be fitted with curves of the form $a+b\sin^2\theta$. The yield of protons for eight elements from carbon to molybdenum was approximately proportional to Z. The yield of neutrons above 7.5 Mev for 19 elements from carbon to lead was approximately proportional to N. Excitation curves were measured for the high-energy protons from aluminum and phosphorus. They have a threshold at about 25 Mev and rise to about 45 Mev. From there on they are nearly constant. An attempt was made to detect proton-neutron coincidences from a carbon target. No true coincidences were found. It is concluded that the measurements are in good agreement with an independent particle model but that they agree only partly with a deuteron model. (auth)

2450

EFFECTS OF ISOTOPIC SPIN SELECTION RULES ON PHOTONUCLEAR YIELDS. H. Morinaga (Iowa State Coll., Ames). Phys. Rev. 97, 444-6(1955) Jan. 15.

The effects of isotopic spin selection rules were taken into consideration in order to explain the observed high ratio of (γ,p) to (γ,n) cross sections. The recent experimental evidence on the separate giant resonances for (γ,p) and (γ,n) cross sections seems to support this viewpoint. (auth)

2451

DEUTERIUM He^3 REACTION. W. E. Kunz (Oak Ridge National Lab., Tenn.). Phys. Rev. 97, 456-62(1955) Jan. 15.

By the use of accelerated He^3 ions, the reaction $H^2(He^3,p)He^4$ has been studied in the energy range 100 to 800 kev (He^3 energy). The angular distribution of the protons was found to be isotropic at bombarding energies of 200, 290, and 350 kev. The reaction cross section has a peak of 695 ± 14 mb as determined with reference to the peak value 5.00 b for the comparison reaction, $H^3(H^2,n)He^4$. The comparison was effected by alternately bombarding the same deuterium target with tritium and He^3 ions, and counting the alpha particles. The peak occurred at 640-kev He^3 ion bombarding energy. From considerations of the absolute value of the cross section, it is concluded that the resonance at 640 kev is associated with a $J=\frac{3}{2}$ level in the compound nucleus. The experimental shape of the peak is well fitted by resonance parameters in the one-level dispersion formula having the following values: interaction radius R, 5×10^{-13} cm; reduced width for proton emission γ_p, 41.9 kev; reduced scattering width γ_α, 2930 kev; "formal" resonance energy in the center-of-mass system ϵ_s, 391 kev; energy of the level above the ground state of Li^5: 16.2 ± 0.3 Mev. These values agree within experimental error with analogous values associated with the similar resonance which occurs in the $H^2(H^3,n)He^4$ reaction. (auth)

2452

MULTIPLICITY OF NEUTRONS FROM THE SPONTANEOUS FISSION OF CALIFORNIUM-252. Donald A. Hicks, John Ise, Jr., and Robert V. Pyle (Univ. of California, Berkeley). Phys. Rev. 97, 564-5(1955) Jan. 15.

Preliminary results on the neutron number distribution arising from the spontaneous fission of Cf^{252} were obtained by mounting the sample in a fission chamber placed at the center of cylindrical tank of Cd-loaded liquid scintillator. A pulse from the fission chamber triggered the sweep of an oscilloscope. The fission neutrons were moderated in the toluene and captured in the Cd with a mean lifetime of 20 μsec, and some of the resulting γ rays produced pulses in the scintillator which were displayed on the scope trace and photographically recorded. From 8494 fissions observed, an average of 1.43 neutrons were detected, as compared with 3.10 ± 0.18 neutrons per spontaneous fission as measured by Crane et al. (Phys. Rev. 97, 242 (1955)). (L.M.T.)

2453

PROTON-GAMMA RESONANCES IN MAGNESIUM. S. E. Hunt and D. A. Hancock (Associated Electrical Industries Ltd., Aldermaston, Berks., England). Phys. Rev. 97, 567-8 (1955) Jan. 15.

Resonances of $3.16.7\pm0.7$, 391.5 ± 0.5, 436.5 ± 04, 495.6 ± 0.6, 513.4 ± 0.7, and 530.4 ± 0.7 kev were obtained from the $Mg^{25}(p,\gamma)Al^{26*}$ reaction. Comparison of the γ yields with the positron yields of other investigators is made. (L.M.T.)

2454

GAMMA-RAYS FROM PROTON BOMBARDMENT OF SODIUM. K. Nybō and T. Grotdal (Univ. of Bergen, Norway). Nature 175, 130(1955) Jan. 15.

The yield of the (p,γ) capture process in Na^{23} was studied for proton energies ranging between 0.5 and 1.0 Mev. Data are tabulated and compared with results of other authors. (C.H.)

2455

THE ANGULAR DISTRIBUTION OF THE GAMMA-RAYS FROM THE REACTION $C^{12}(p,\gamma p')C^{12}$. S. A. Heiberg, D. B. James, and T. K. Alexander (Univ. of British Columbia, Vancouver). Can. J. Phys. 33, 34(1955) Jan.

The angular distribution of γ rays from the reaction $C^{12}(p,\gamma p')C^{12}$ has been measured at 5 angles and can be represented by $(0.02\pm0.02)+\sin^2\theta$ at proton bombarding energies of 1.37 and 1.58 Mev. The hypothesis that the capture mechanism is one of direct radiative capture is confirmed. (M.P.G.)

PARTICLE ACCELERATORS

2456 CERN/T/AET-1

[European Council for Nuclear Research]

REPORT ON RESEARCH WORK WITH THE CYCLOTRON AT GUSTAF WERNER'S INSTITUTE FOR NUCLEAR CHEMISTRY IN UPPSALA DURING THE PERIOD FROM APRIL 1 TO APRIL 30, 1953. A. E. Taylor. May 5, 1953. 3p.

Preliminary magnetic measurements concerned with the extraction of a fraction of the internal proton beam of the proton synchrotron are described. Apparatus described briefly includes a triple coincidence circuit and attenuators for neutron total cross sections. (C.H.)

2457 CERN/T/AET-2

[European Council for Nuclear Research]

REPORT ON RESEARCH WORK WITH THE CYCLOTRON AT GUSTAF WERNER'S INSTITUTE FOR NUCLEAR CHEMISTRY IN UPPSALA DURING THE PERIOD FROM MAY 1 TO JUNE 15, 1953. A. E. Taylor. June 17, 1953. 2p.

A triple coincidence telescope using plastic phosphor

crystals and EMI photomultipliers together with a BF_3 monitor were found to provide suitable detection for high energy neutrons from the proton synchrotron. A rough measurement was made of the neutron spectrum in the forward direction from a one cm thick Be target bombarded by the internal proton beam at maximum energy. A measurement of the total cross section of C for an effective neutron energy of 170 Mev gave a value of 367 ± 37 × 10^{-27} cm^2. (For preceding report in series see CERN/T/AET-1.) (C.H.)

2458 CERN/T/AET-3
[European Council for Nuclear Research]
REPORT ON RESEARCH WORK WITH THE CYCLOTRON AT GUSTAF WERNER'S INSTITUTE FOR NUCLEAR CHEMISTRY IN UPPSALA. A. E. Taylor. July 6, 1953. 1p.

Progress is reported in increasing the internal proton beam of the proton synchrotron. The energy spectrum of the internal proton beam was measured, indicating a half width of 12 Mev for the maximum radius. Total cross sections were determined as 327 ± 3 ± mb for C, 49 ± 1.6 mb for H, 433 ± 7 mb for 0, and 72 ± 3.5 for D. (For preceding report in series see CERN/T/AET-2.) (C.H.)

2459 CERN/T/AET-4
[European Council for Nuclear Research]
REPORT ON RESEARCH WORK WITH THE CYCLOTRON AT FUSTAF WERNER'S INSTITUTE FOR NUCLEAR CHEMISTRY IN UPPSALA. A. E. Taylor. Sept. 30, 1953. 1p.

A proton beam has now been extracted from the cyclotron. There are small adjustments remaining to be made which should increase the beam still further from the value of 10^7 protons per second obtained on first switching on. An air lock and long vacuum tube have yet to be made in order to bring the proton beam into the experimental laboratory without undue loss. It is also proposed to build an electrostatic focussing unit similar to the one used at Harwell. The results obtained when determining the internal proton spectrum have been briefly summarized in the accompanying report, which also gives a brief description of the extraction problem. In view of the importance of the variation in the spectrum with cyclotron conditions, more investigations along these lines are planned. A further determination of the difference between the deuterium and hydrogen cross section has been made at 119 Mev, giving a value of 27.2 ± 2.4 mb. (Entire report.)

2460 CERN/T/AET-5
[European Council for Nuclear Research]
INTERNAL BEAM MEASUREMENTS AND THE DEFLECTION PROTONS FORM THE GUSTAF WERNER INSTITUTE CYCLOTRON. A. E. Taylor. Sept. 30, 1953. 10p.

Data are presented on the beam intensity, energy spectrum, and deflection of protons in the proton synchrotron. (C.H.)

2461 CERN/T/CF-1
European Council for Nuclear Research
ON THE EQUATIONS OF MOTION OF PARTICLES MOVING IN THE ALTERNATIVE GRADIENT PROTON ACCELLERATOR. Christian Fronsdal. [1952?]. 10p.

It has been suggested that the 4-pole 4-quadrant magnet configuration proposed for the alternating gradient proton synchrotron could be replaced by a 2-pole configuration in 1 quadrant. One pole piece would be the same as in the original arrangement, while the other would occupy the area between the hyperbolic equipotential line and the asymptotes of the hyperbola. The equations of motion of a particle moving close to the equilibrium orbit in the new magnet configuration are similar to the equations in the original arrangement except for an additional coupling term. The stability conditions for the two arrangements are compared. It is found that the coupling term requires more restrictive but no prohibitive stability conditions. With the new magnet configuration, the length of the sections should not be varied by more than 10% along the orbit. (M.P.G.)

2462 CERN/T/GL/3
European Council for Nuclear Research
REMARKS ON A MANUSCRIPT BY J. D. LAWSON. Gerhart Lüders. Dec. 1952. 9p.

Lawson has pointed out that there might be essential difficulties in operating a synchrotron according to the strong focusing scheme. It was suggested that magnet inhomogeneities might have a systematic tendency to move particles away from the equilibrium orbit. In the present paper, some preliminary considerations on this problem are presented. A method is outlined for studying the effects of nonlinearities. It is suggested that it may be possible to overcome the difficulties by special placement of the pole pieces. (M.P.G.)

2463 CERN/T/TS-2
European Council for Nuclear Research
BETATRON OSCILLATIONS IN THE STRONG FOCUSSING SYN[C]HROTRON. Thorbjorn Sigurgeirsson. Dec. 1952. 17p.

The mathematical theory underlying the focusing in a stationary periodic magnetic field is reviewed. An expression is derived for an envelope to all particle orbits. It is shown that the admittance—the product of average useful solid angle and cross section area of the envelope—is independent of the place, where the cross section is taken. The value of ϵ ($=n/N^2$), that gives the heighest admittance, is determined in case of n being a constant, alternatively positive and negative, and in the case of $n = n_0 \cdot \cos(2\pi s/L)$. The magnetic field energy inside the vacuum chamber, which is needed to obtain a certain admittance, is calculated and comparison made between the two cases mentioned above. All calculations rest on the assumption that there exists one or more closed equilibrium orbits and that the magnetic field varies linearly in a plane perpendicular to the equilibrium orbit. (auth)

2464 CERN/T/TS-3
European Council for Nuclear Research
FOCUSSING IN A SYNCHROTRON WITH PERIODIC FIELD PERTURBATION TREATMENT. Thorbjorn Sigurgeirsson. May 1953. 13p.

The motion of a particle in the synchrotron is described by the deviations from a reference orbit which can be any particle orbit in the synchrotron. The magnetic guide field is split up in two parts: the bending field, which is the field on the reference orbit, and the focusing field, which is zero on the reference orbit. The motion of a particle with respect to the reference orbit is nearly the same as it would be if the reference orbit was straightened out and the bending field removed. The mean path of a particle in the periodic field of the synchrotron is approximately the same

as the path of a particle moving in a field of force with potential proportional to the square of the focussing field strength. The calculations are carried out in three dimensions and are valid both for linear and non linear magnetic fields. A new type of pole faces for the strong-focusing synchrotron is described. (auth)

2465 UCRL-2795

Radiation Lab., Univ. of Calif., Berkeley

FOCUSING IN LINEAR ION ACCELERATORS. Lloyd Smith and Robert L. Gluckstern. Nov. 24, 1954. 30p. Contract W-7405-eng-48.

The results of the investigation of three methods of obtaining transverse stability in linear accelerators for ions are presented and discussed. For electric or magnetic quadrupole focusing, the range of stable operation, oscillation amplitudes, and the effect of perturbing errors are treated. For grid focusing, the operation of an actual grid is analyzed from measurements of the field distribution. Finally, the formulas applicable to focusing by axial magnetic lenses are presented. (auth)

2466

SYNCHROTRON OSCILLATIONS INDUCED BY RADIATION FLUCTUATIONS. Matthew Sands (California Inst. of Tech., Pasadena). Phys. Rev. 97, 470-3(1955) Jan. 15.

Phase oscillations of electrons in a high-energy synchrotron are induced by the radiation of quanta. These induced oscillations set a limit to the damping of electron bunches. This limiting bunches. This limiting bunch size is sufficient to influence the radial aperture and the radio-frequency voltage required at low beam intensities, and to reduce energy loss by coherent radiation at high intensities. (auth)

2467

THE CALCULATION OF VOLTAGE SURGES IN A VAN DE GRAAFF GENERATOR. B. Millar (Associated Electrical Industries Ltd., Aldermaston, Berks, England). Brit. J. Appl. Phys. 6, 13-15(1955) Jan.

Calculations have been made on the transient voltage changes occurring in the stack of a Van de Graaff electrostatic generator under spark-over conditions, and it is shown that these changes are strongly influenced by the capacitances from the stack plates to the tank. Breakdown between two adjacent stack plates may lead to the breakdown of the whole generator. Radial breakdown can cause the potential between adjacent stack plates to be reversed in polarity and increased in magnitude to several times its normal value. The insertion of resistors between accelerator tube electrodes and the adjacent stack plates can protect the accelerator tube from damage in the event of axial breakdown of the generator stack. (auth)

2468

A NOTE ON THE X-RAY SPECTRUM OF A 70 MEV SYNCHROTRON. L. E. H. Trainor and S. B. Brown (Queen's Univ., Kingston, Ontario, Canada). Can. J. Phys. 33, 110-12(1955) Feb.

2469

LIQUID HYDROGEN, DEUTERIUM, AND HELIUM TARGET FOR USE WITH HIGH-ENERGY MACHINES. E. A. Whalin Jr. and R. A. Reitz (Univ. of Illinois, Urbana). Rev. Sci. Instr. 26, 59-65(1955) Jan.

A well-localized target of hydrogen, deuterium, or helium has been developed for use with the University of Illinois 300-Mev betatron. The liquefied target gas is contained in a thin-walled brass cylinder in contact with a low-temperature reservoir. For hydrogen and deuterium targets the reservoir contains hydrogen, while for a helium target the reservoir contains helium. Target cylinders of 1.25-inch diameter with 0.0005-inch walls and 2 and 4-inch diameter with 0.001-inch walls have been used giving proton and meson backgrounds from the cylinder walls of less than 10%. A liquid nitrogen cooled radiation shield surrounds the target and reservoir. The nitrogen shield and the vacuum jacket enclosing it have thin windows allowing one to study the production of protons of energy >20 Mev and mesons of energy >7 Mev. From the 3-liter reservoir the loss rate of liquid hydrogen is 40 ml per hour and of liquid helium is 250 ml per hour. (auth)

RADIATION ABSORPTION AND SCATTERING

2470 AECU-2956

California Univ., Los Angeles

ELASTIC SCATTERING OF 20.6-MEV PROTONS BY DEUTERONS. David O. Caldwell and J. Reginald Richardson. July 1954. 71p. Sponsored by ONR and AEC under Contract N6onr-275, T. O. 4, Technical Report No. 22.

The absolute differential cross section for the elastic scattering of 20.6-Mev protons by deuterons was measured, using the external beam of the U.C.L.A. synchrocyclotron. A triple-coincidence proportional counter telescope, with variable absorbers between the second and third counters and differential pulse-height discriminators (set by a new method) on the first two counters, was used to select the desired particle by range and specific ionization. Deuterium gas at atmospheric pressure provided the target for the proton beam, which was collimated to $\frac{1}{8}$" diameter, with a maximum angular divergence of $\frac{1}{2}°$. An interchangeable slit system was used to give angular resolutions of 0.9° or 1.8°. Absolute measurements were made at 22 angles from 12° to 164° (center of mass) with an accuracy varying approximately from 1% to 3%, depending upon the angle. The cross section shows the familiar deep minimum (near 130° in the present case), but in addition a shallower minimum near 18°, due to Coulomb-nuclear interference. This latter minimum should allow fitting the data with a unique set of phase shifts. Heretofore such three-body scattering experiments have by themselves yielded two ambiguous sets of phase shifts, corresponding to the ambiguity in the doublet and quartet scattering lengths. This experiment, then, ought to provide a more stringent test for theories than previous low or intermediate energy nucleon-deuteron scatterings. (auth)

2471 NP-5503

Florida Univ. Coll. of Engineering. Engineering and Industrial Experiment Station

MEASUREMENTS OF THE ELASTIC AND INELASTIC SCATTERING OF H^- IONS IN HYDROGEN. E. E. Muschlitz, Jr., T. L. Bailey, and J. H. Simons. Dec. 1954. 52p. Contract Nonr-580(01).

An apparatus for the production of beams of negative ions and the measurement of negative ion scattering is described. A new ion source specifically designed for the production of negative ions is used. The apparatus consists of the ion source, a 90° mass spectrometer, electrostatic ion beam focusing systems, and a scattering chamber for the measurement of both elastic and inelastic collisions of negative ions in gases at low pressures. Measurements

are given of the elastic and inelastic cross sections for the scattering of 4 to 400 ev H^- ions in H. The interaction potential derived from the elastic scattering at low energies is very nearly that arising from the polarization of the molecule by the ion. The inelastic scattering is presumed to be due to electron detachment. Inelastic collisions persist to very low ion energies and become more probable with increasing ion energy. The increase in the elastic cross section with increasing ion energy observed at high energies is attributed to electronic excitation of the H molecule. (auth)

2472 NYO-3075

Nuclear Development Associates, Inc.

CALCULATIONS OF THE PENETRATIONS OF GAMMA RAYS. FINAL REPORT. Herbert Goldstein and J. Ernest Wilkins, Jr. June 30, 1954. 203p. Contract AT(30-1)-862. (NDA-15C-41)

An extensive series of calculations on the penetration of γ rays in infinite homogeneous media has been made using the "moments method." Spectra of scattered photons, due to monoenergetic sources ranging in energy from 0.5 to 10 Mev, were obtained at distances up to 20 mean-free-path lengths in eight materials whose atomic numbers varied from 0 to 92. Source geometries included point isotropic and plane monodirectional. The computations were performed with the aid of a high speed automatic computer. The choice of microscopic absorption coefficients for the calculation is discussed at length, and the data used are reproduced. Definitions are given for the quantities describing the scattered photons, and the fundamental equation governing the photon transport is derived. The "moments method" is described in detail, both as to the derivation and integration of the equations for the spatial moments of the flux, and as to the procedures for reconstructing the flux from the moments. Scattered flux spectra and buildup factors are reproduced for all the calculated problems in the form of some 140 tables and 75 graphs. Methods for extending the results to problems not calculated are described. Possible sources of error are discussed. It is concluded on the basis of internal checks, comparison with other theoretical predictions, and examination of published experiments, that the accuracy of the calculations is more than adequate for almost all practical applications. (auth)

2473 PD-195

National Research Council [of Canada]. Div. of Atomic Energy

RELATIVE ACCURACY IN COMPARING THE CROSS-SECTIONS OF URANIUM AND GRAPHITE SAMPLES BY THE SWING METHOD. F. J. M. Farley. Aug. 6, 1946. 3p.

It is shown that the percentage accuracy in comparing cross sections of U and graphite samples by the Sw method is approximately the same when the U sample is a 2 in. right cylinder and the graphite sample is 7¼ by 7¼ by 29 in. An accuracy of 0.1% may be achieved in measuring U by using 7 cylinders of U per graphite block. (M.P.G.)

2474 UCRL-4436

Radiation Lab., Univ. of Calif., Livermore

OPTICAL MODEL ANALYSIS OF SCATTERING OF 14 MEV NEUTRONS. Glen Culler, Sidney Fernbach, and Noah Sherman. Jan. 10, 1955. 28p. Contract W-7405-eng-48.

Preliminary results for the scattering of 14-Mev neutrons using exact phase-shift calculations are presented. The model used consists of step-well potentials both with and without spin-orbit interactions. (auth)

2475 AEC-tr-2070

DYNAMIC PRESSURE STAGE ELEMENTS FOR THE PROJECTION OF INTENSE MONOKINETIC CORPUSCULAR BEAMS INTO GASES AT HIGH PRESSURE. B. Schumacher. Translated from Optik 10, 116-31(1953). 13p. Available from Associated Technical Services (Trans. 83F4G), East Orange, N. J.

It is possible to lead a corpuscular ray out of a high-vacuum chamber into gas chambers with pressures of many atmospheres through openings of a few tenths of a millimeter in diameter across one or two intermediate chambers at lower pressure. It is shown that in order to pump out the gas flowing into the lower pressure regions, small commercial pumps are adequate, provided that the equipment is properly designed. Three designs are described which permit the projection of monokinetic electron and ion beams with current intensities of up to 0.5 mA into gases, and also permit the beams to be brought again into vacuum, after passage through a thin layer of gas. The complete course of the diffusion of an electron beam in ordinary air is shown in a picture (electron scatter sphere). Possible applications of the device are discussed; as an example, the electron silhouette of a gas flow is shown. (auth)

2476 AEC-tr-2071

MEASUREMENT OF MEAN FREE COURSE OF TRANSPORT OF THERMAL NEUTRONS IN HEAVY WATER BY MEANS OF A MODULATED SOURCE. Victor Raievski and Jules Horowitz. Translated from Compt. rend. 238, 1993-5(1954). 4p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-4739.

2477 AEC-tr-2072

APPLICATION OF INTENSE CORPUSCULAR BEAMS FOR THE EXCITATION OF GASES. A. E. Grün, E. Schopper, and B. Schumacher. Translated from Z. angew. Phys. 6, 198-200(1954). 4p. Available from Associated Technical Services (Trans. 84F4G), East Orange, N. J.

The excitation of gases by beams of fast particles represent an expansion of the usual excitation procedures. It is characterized, among others, by well defined excitation conditions. After reference to a procedure for the generation of intense corpuscular beams by means of dynamic pressure stages, several applications are shown. Particularly, the localized excitation of a gas jet by an intense corpuscular beam of small cross section permits the stationary observation of decay processes in the plasma. (auth)

2478

THE APPLICATION OF VARIATIONAL METHODS TO ATOMIC SCATTERING PROBLEMS. IV. THE EXCITATION OF THE 2^1S AND 2^3S STATES OF HELIUM BY ELECTRON IMPACT. H. S. W. Massey and B. L. Moiseiwitsch (Univ. Coll., London, England). Proc. Roy. Soc. (London) A227, 38-51(1954) Dec. 21.

The zero-order partial cross sections for the excitation of the 2^1S and 2^3S states of He by electron impact are calculated with full allowance for distortion of the initial and final electron waves by potential and exchange interaction with the atom in its initial and final state respectively. The

distorted waves are determined by a variational method. Allowance for distortion reduces the cross sections by a factor of 10 or more and brings them into good agreement with the rather meagre observational data. In particular, a near-resonance effect in the distortion of the electron wave by the potential and exchange interaction with a He atom in the 2^3S state, near the zero-energy limit, leads to a very sharp maximum in the excitation cross section for this state for electron energies within a fraction of an electron volt of the threshold. At electron energies of a few electron volts beyond the threshold the contribution of the first-order partial cross section is not negligible. It has been estimated neglecting distortion, which is certainly much less important than for the zero-order cross sections. Comparison has then been made between the calculated total cross sections at energies of 4 to 20 ev beyond the threshold and those deduced by indirect methods from the observations of Dorrestein. Agreement is good in view of the neglect of distortion in the first-order cross section, the neglect of higher order cross sections in the theoretical curve, and the uncertainties involved in the analysis of the observed data. The Born-Oppenheimer cross sections, neglecting distortion in the zero order as well as all higher order cross sections, are at least 20 times too large for electron energies up to 40 ev. (auth)

2479

THE COHERENT SCATTERING OF γ-RAYS BY K ELECTRONS IN HEAVY ATOMS. I. METHOD. G. E. Brown, R. E. Peierls, and J. B. Woodward (Univ. of Birmingham, England). Proc. Roy. Soc. (London) A227, 51-8(1954) Dec. 21.

A method for evaluating transition amplitudes for bound electrons in second order in the effects of the radiation field is outlined. An example of the type of problem concerned is the coherent scattering of γ rays by the K electrons in heavy atoms. The static field in which the electron moves is taken into account exactly. No expansion is made in its effects. In the usual perturbation theory this is equivalent to summing matrix elements over intermediate states which are solutions of the wave equation including the static potential. In the method presented here, however, the sum over radial eigenstates for a particular angular momentum of intermediate state is replaced by quadratures of the products of known functions with the solution of a pair of coupled inhomogeneous differential equations. (auth)

2480

THE COHERENT SCATTERING OF γ-RAYS BY K ELECTRONS IN HEAVY ATOMS. II. THE SCATTERING OF 0.32 MC^2 γ-RAYS IN MERCURY. Sheila Brenner, G. E. Brown, and J. B. Woodward (Univ. of Birmingham, England). Proc. Roy. Soc. (London) A227, 59-72(1954) Dec. 21.

The results of calculations for the coherent scattering of γ rays of energy 0.32 mc^2 by K electrons in mercury are given in a form which enables one to determine scattering cross sections at any angle, for any initial and final polarizations, and for any spin orientation of the electrons. The method used in doing the computation is that described in part I, the main part of the work having been performed on the EDSAC computer at the University of Cambridge. The dispersive contribution to the cross section agrees with previous approximate calculations. The absorptive part is calculated as well and has the effect of adding to the cross section a contribution approximately equal to one-sixth of the dispersive contribution at all angles of scattering. (auth)

2481

ELASTIC SCATTERING AND POLARIZATION OF D-D NEUTRONS BY CARBON. R. W. Meier, P. Scherrer, and G. Trumpy (Physikalisches Institut der ETH, Zurich, Switzerland). Helv. Phys. Acta 27, 577-612(1954) Dec. (In German)

The angular distribution and the azimuthal asymmetry of elastically scattered D-D neutrons by carbon for 9 different energies in the range of 2.4 to 3.65 Mev have been determined. The results, corrected for geometrical resolution, multiple scattering, and detector efficiency, are expressed in Racah formalism and analysed analytically in terms of phase shifts. The s phase is in agreement with hardsphere scattering, whereas the p phases are split in the whole energy range, p 3/2 being nearly zero. Two resonances at 7.58 Mev (Γ = 0.060 Mev) and 8.23 Mev (Γ = 1.20 Mev) exitation energy, both of $3/2^+$ type, are observed. This is a very unusual case of two strongly interfering levels with equal total angular momentum and equal parity but with a difference in width of a factor of 20. The differential polarization of carbon as a function of angle and energy is calculated with these phase shifts. The general behaviour is a $\sin(2\vartheta)$ dependence giving a degree of polarization P_2 not far from 100 % near 50^0 and 130^0 scattering angle over most of the investigated energy interval. With these results the degree of polarization $P_1(E_D,\Theta)$ of the D-D neutrons can be calculated from the measured azimuthal asymmetry. The angular dependence at a mean energy of E_D = 600 kev is expressed by

$$P_1(\Theta) = \frac{-(0{,}165 \pm 0{,}017)\sin(2\Theta)}{1 + 1{,}15\cos^2\Theta + 0{,}75\cos^4\Theta}$$

with maximum values $P_{max} = (10.8 \pm 1.2)$ % at angles $\Theta = 58^0$ and $\Theta = 122^0$ in the center of mass system. The sign is in agreement with the sign of the proton polarization of the competing reaction D(d,p)T. (auth)

2482

THE INFLUENCE OF ELECTRIC QUADRUPOLE EFFECT ON THE DIRECTIONAL CORRELATION OF SUCCESSIVE NUCLEAR RADIATIONS (Cd^{111}). H. Albers-Schonberg, E. Heer, and P. Scherrer (Physikalisches Institut der Eidgenossischen Technischen Hochscule, Zurich, Switzerland). Helv. Phys. Acta 27, 637-66(1954) Dec. (In German)

The influence of extranuclear fields on the angular correlation of successive nuclear radiations is discussed. It is shown that in the case of the Cd^{111} $\gamma-\gamma$ cascade, most of the observed attenuation effects can be explained by the electric quadrupole interaction. In some cases magnetic dipole interaction with the excited electron shell may also be of importance. Methods are described to decide if a measured correlation is attenuated or not and to determine the coefficients of the undisturbed correlation function in those cases where only sources with non vanishing interaction are available. (auth)

2483

THE MULTIPLE SCATTERING OF PROTONS IN NUCLEAR EMULSIONS. J. R. Bird and K. C. Hines (Univ. of Melbourne, Australia). Australian J. Phys. 7, 586-600 (1954) Dec.

The multiple scattering theories of Williams and Moliére have been adapted to give the rms latheral deflection of protons which lose all their energy in nuclear emulsions. Measurements of 1 to 5 Mev proton tracks show significant differences from the former theory at low

energies and from the latter at higher energies. The introduction of alternative expressions for the minimum angle due to screening does not give a satisfactory explanation of the observed results. It is found, however, that the experimental rms deflections display the same dependence on maximum single scattering angle as is calculated. (auth)

2484

SCATTERING OF 4.9 MEV PROTONS BY ^{27}Al. K. B. Mather (Univ. of Melbourne, Australia). Australian J. Phys. 7, 658-60(1954) Dec.

The energy levels of Al^{27} below 4 Mev have been obtained by scattering 4.90 Mev protons from a thin Al target. Track ranges were measured. Approximately 89% of the tracks were associated with the elastic scattering peak centered at a range of 160μ while 11% had ranges less than 130μ. Four excited states were detected at 0.83, 1.01, 2.22, and 3.01 Mev. Intensity estimates for each state and absolute values of differential cross sections are listed. (M.P.G.)

2485

SCATTERING OF 0.6-, 1.0-, AND 1.7-MEV ELECTRONS FROM ALUMINUM AND GOLD. Robert T. Bayard and J. L. Yntema (Univ. of Pittsburgh, Penna.). Phys. Rev. 97, 372-9(1955) Jan. 15.

The relative differential cross sections for the scattering of electrons by gold and aluminum has been measured at 0.6, 1.0, and 1.7 Mev over the angular range 30° to 150°. No significant deviation from the theoretically expected angular distribution was observed. Absolute differential cross sections were measured at 60° for aluminum at the same energies. The data are in agreement with the theoretical predictions within the experimental error. (auth)

2486

CHARGE EQUILIBRIUM RATIOS FOR HYDROGEN IONS FROM SOLIDS. James A. Phillips (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 97, 404-10(1955) Jan. 15.

Experimental values for the ratios of the positive, neutral, and negative components have been obtained for proton beams in the energy region 3 to 200 kev emerging from Al, Be, Ca, Ag, Au, and SiO foils. Clean surfaces were obtained by evaporating fresh material onto the foil during a run. As expected, the equilibrium charge ratio appears to be determined by the last few ($\sim$5) atoms on the exit side of the foil. At 37 $\pm$ 3 kev, the positive and neutral components are equal for all materials tested, except Ca (18 $\pm$ 2 kev). Significant differences have been found in the charged components from these metals. The observed ratios of the components for different metals parallel their work functions at proton energies > 100 kev. (auth)

2487

MAGNETIC SCATTERING OF SLOW NEUTRONS FROM O_2 GAS. W. H. Kleiner (Massachusetts Inst. of Tech., Lexington). Phys. Rev. 97, 411-18(1955) Jan. 15.

A general expression is derived for magnetic scattering of slow neutrons from oxygen gas which takes account of molecular rotation. The scattering derived on the basis of Meckler's ground electronic wave function for O_2 is discussed. The validity of the static or semiclassical approximation is considered. Values are given for the total magnetic cross section in laboratory coordinates based on Meckler's wave function. The magnetic scattering does not appear to be sufficiently sensitive to changes in the wave function to distinguish in practice between different reasonable approximate wave functions. (auth)

2488

SCATTERING OF 119-MEV PIONS BY DEUTERIUM. D. E. Nagle (Univ. of Chicago, Ill.). Phys. Rev. 97, 480-6(1955) Jan. 15.

The angular distributions for the scattering of negative pions by liquid deuterium was measured, using the 119-Mev pion beam of the Chicago cyclotron and scintillation counters. The values of the nonexchange scattering differential cross section in the laboratory system for angles of 45, 90, and 135° are 8.50 $\pm$ 0.31, 5.31 $\pm$ 0.20, and 8.36 $\pm$ 0.29 in units 10^{-27} cm^2 steradian^{-1}. The differential cross sections for the production of photons at the same angles and in the same units are 2.20 $\pm$ 0.27, 241 $\pm$ 0.28, and 3.40 $\pm$ 0.38. The total cross section from transmission measurements is (132 $\pm$ 7) $\times$ 10^{-27} cm^2. These values are somewhat less than the sum of the previously measured cross sections for positive and for negative pions on hydrogen. (auth)

2489

LANDAU DISTRIBUTION AND DENSITY EFFECT AT HIGH GAS PRESSURES. E. D. Palmatier, J. T. Meers, and C. M. Askey (Univ. of North Carolina, Chapel Hill). Phys. Rev. 97, 486-90(1955) Jan. 15.

Studies of the ionization energy losses of fast μ mesons have been carried out in a specially constructed proportional counter with argon gas at pressures up to 40 atmospheres. With increasing pressure, a strong reduction in the relativistic rise was observed; the extent of the reduction being at least as great as that expected from Sternheimer's calculation of the density effect. Furthermore, the distribution in energy losses, which at low pressures is much wider than expected from theoretical considerations, was observed to become narrower with increasing pressure. At the highest pressure, however, the energy loss distribution was still considerably wider than predicted by the Landau theory. (auth)

2490

MEASUREMENTS OF SPECTRAL AND ANGULAR DISTRIBUTIONS OF SECONDARY GAMMA-RAYS IN MATTER. G. N. Whyte (National Research Council, Ottawa, Ontario, Canada). Can. J. Phys. 33, 96-109(1955) Feb.

The distribution in energy and angle of the secondary gamma radiation emerging from the face of a concrete barrier containing a point source of Co 60 has been measured as a function of barrier thickness. Results on energy spectra and angular distributions are presented, and some of their features are compared with theoretical predictions. The operation of the two-crystal spectrometer and the photographic system for recording pulse-height distributions are described in some detail. (auth)

2491

ELASTIC SCATTERING OF 660-MEV PROTONS BY PROTONS. N. P. Bogachev and I. K. Vzorov (Inst. of Nuclear Problems). Doklady Akad. Nauk S.S.S.R. 99, 931-3(1954) Dec. 21. (In Russian)

Measured differential cross sections for (p,p) scattering of 657-Mev protons produced by the Institute of Nuclear Problems (Academy of Sciences, S.S.S.R.) synchrocyclotron are plotted. (G.Y.)

2492

ELASTIC SCATTERING OF 380 MEV NEUTRONS BY PROTONS. V. P. Dzhelepov and Yu. M. Kazarinov (Inst. of Nuclear Problems). Doklady Akad. Nauk S.S.S.R. 99, 939-42(1954) Dec. 21. (In Russian)

Energy distribution of neutron beams produced by the

Institute of Nuclear Problems synchrocyclotron and differential cross sections for (n,p) scattering of neutrons of 380 Mev. Average energy on graphite and paraffin are presented graphically. (G.Y.)

2493

ANOMALOUS VARIATIONS IN CROSS SECTION FOR ELASTIC SCATTERING OF PROTONS BY PROTONS IN THE 460 to 660 MEV REGION. M. G. Mescheryakov. B. S. Neganov, L. N. Soroko, and I. K. Vzorov (Inst. of Nuclear Problems). Doklady Akad. Nauk S.S.S.R. 99, 959-61(1954) Dec. 21. (In Russian)

Differential (p,p) cross sections at 30 and 90° are compared for 460, 562, 610, 634, 645, and 657 Mev protons. The contributions of $p + p \rightarrow \pi^+ + n + p$, $\pi^+ + d$, or $\pi^\circ + 2p$ reactions are discussed. (G.Y.)

2494

SOME OBSERVATIONS ON THE PROBABILITY DISTRIBUTION OF X-RAY INTENSITIES. A. Hargreaves (College of Technology, Manchester, England). Acta Cryst. 8, 12-14 (1955) Jan.

Wilson's theory for the probability distribution of x-ray intensities applies only when the unit cell contains a number of atoms of similar scattering power. Consideration is given to the way the distribution is modified when the intensities are dominated by a single atom in the unit of pattern of the structure. (auth)

2495

SCATTER OF HIGH-ENERGY ELECTRONS IN CRYSTALS. M. L. Ter-Mikaelyan. Zhur. Eksptl'. i Teoret. Fiz. 25, No. 3, 289-95(1953). (In Russian)

Analyses of scattering the relativistic electrons in periodic media, from a diatomic molecule to the simple cubic lattice are presented. It is shown that, although the wavelength of the scattering electron is far smaller than the lattice constant (or the molecule dimension), significant corrections are introduced into the conventional scatter formula by allowing for the interference phenomena. (Science Abstracts)

RADIATION EFFECTS

2496 NYO-6511

Massachusetts Inst. of Tech

X-RAY STUDY OF RADIATION DAMAGE. B. E. Warren. Dec. 31, 1954. 5p. Contract AT(30-1)-858.

Single crystals of Cu–2% Si were irradiated in a reactor, receiving a dose of ~ 550 Mwd/at. X-ray measurements revealed no effect of irradiation on integrated intensities and no measurable peak shift or broadening of the peaks. When the irradiated samples were etched for times of the order of 30 min, extremely broad x-ray peaks were obtained. The same etches on unirradiated samples gave no effect. (M.P.G.)

2497

NEUTRON DAMAGE TO THE STRUCTURE OF VITREOUS SILICA. Joseph S. Lukesh (Knolls Atomic Power Lab., Schenectady, N. Y.). Phys. Rev. 97, 345-6(1955) Jan. 15.

The x-ray diffraction pattern of vitreous silica has been investigated before and after exposure to neutrons. Small, but significant, changes are observed. A relation between these changes and those caused by neutron damage to crystalline forms of silica is suggested. (auth)

2498

IRRADIATION OF EXPLOSIVES WITH HIGH-SPEED PARTICLES AND THE INFLUENCE OF CRYSTAL SIZE ON EXPLOSION. F. P. Bowden and K. Singh (Univ. of Cambridge, England). Proc. Roy. Soc. (London) A227, 22-37(1954) Dec. 21.

The effect of irradiating a number of sensitive explosive crystals (such as lead azide, silver azide, cadmium azide, nitrogen iodide and silver acetylide) with high-speed particles has been studied. They were subjected to irradiation by electrons, neutrons, fission products and x rays. All these substances were exploded by an intense electron stream, but experiment shows that this is a thermal effect and is due to a bulk heating of the crystal. Nitrogen iodide is exploded by fission products, but this substance is anomalous. With the other substances interesting changes within the crystal are observed and these affect the subsequent thermal decomposition but no explosion results. The experiments show that, in general, the activation of a small group of adjacent molecules is not enough to cause explosion. The effect of crystal size on explosion is also studied. It is shown that if the crystals are heated they do not explode unless their critical size exceeds a certain value, which depends upon the temperature and upon other factors. Under the conditions of these experiments the limiting size for a number of explosives is of the order of a few microns. The work supports the earlier conclusions (arrived at from friction and impact experiments) that the necessary 'hot-spot' size is large on a molecular scale ($\sim 10^{-5}$ to 10^{-3} cm in diameter); otherwise successful growth to detonation will not occur. Optical and electron microscopy provide some evidence that thermal decomposition takes place preferentially at dislocations inherent in the mosaic structure of the crystal. (auth)

2499

MASS SPECTROMETRIC STUDY OF NATURAL AND NEUTRON-IRRADIATED CHLORINE. A. W. Boyd, F. Brown, and M. Lounsbury (Atomic Energy of Canada Ltd., Chalk River, Ontario). Can J. Phys. 33, 35-42(1955) Feb.

Using a Nier-type mass spectrometer, the isotopic composition of chlorine gas obtained from natural potassium chloride has been measured to be 75.529 ± 0.016 atom per cent Cl^{35} and 24.471 ± 0.016 atom per cent Cl^{37} corresponding to a Cl^{35}/Cl^{37} atom ratio of 3.0865 ± 0.0027. By comparison of this result with that for chlorine gas from potassium chloride irradiated for 14 months in a high flux position of the NRX reactor, the neutron capture cross-section of Cl^{36} has been determined to be 90 ± 25 barns. This value has been calculated on the assumption that only (n, γ) reactions were significant in changing the isotopic composition of the chlorine. (auth)

RADIOACTIVITY

2500 ANL-5386

Argonne National Lab.

RADIATIONS OF Tl^{209}, Pb^{209}, Bi^{213}, AND Ra^{225}. L[awrence] B. Magnusson, F[rank] Wagner, Jr., D[onald] W. Engelkemeir, and M[elvin] S. Freedman. Jan. 1955. 23p. Contract W-31-109-eng-38.

The decay energies and partial decay schemes of members of the 4n + 1 series are deduced from correlations of magnetic lens and scintillation spectrometer data. Bi^{213} emits 1.39-Mev β particles (68%) to the ground state of Po^{213}, and 0.96-Mev β particles to a 437-kev excited state. The 437-kev level decays by M1 radiation to the ground state. Tl^{209} emits 2.3-Mev (ca. 30%) β particles.

The 2.3-Mev branch appears to lead to a 1.6-Mev excited state of Pb^{209}. A lower energy β branch is followed by a 114-kev E1 transition. Pb^{209} has a single β spectrum with 630 kev maximum energy. Ra^{225} emits 320-kev β particles to a 40-kev excited state which decays by E1 radiation. The 6.30, 7.00, and 8.34-Mev α particles of Fr^{221}, At^{217}, and Po^{213}, respectively, are emitted in decay to the ground states of the daughter atoms. The 6.05-Mev α particle attributed to Fr^{221} leads to a 216-kev level in At^{217} which decays by E2 radiation. Evidence is found for excited levels in Fr^{221}. (auth)

2501 CERN/T/A-A-B-M-1

Institut för Teoretish Fysik, Copenhagen (Denmark)

INTENSITY RULES FOR NUCLEAR BETA AND GAMMA TRANSITIONS TO ROTATIONAL STATES. G. Alaga and A. Bohr, Institut för Teoretish Fysik, Copenhagen (Denmark) and K. Alder and B. R. Mottelson, European Council for Nuclear Research. Aug. 1954. 34p.

2502 CERN/T/B-F-M-1

Institut för Teoretish Fysik, Copenhagen (Denmark)

ON THE FINE STRUCTURE IN ALPHA DECAY. A. Bohr, Institut för Teoretish Fysik, Copenhagen (Denmark) and P. O. Fröman and B. R. Mottelson, European Council for Nuclear Research. Aug. 1954. 24p.

2503 CERN/T/OKH-1

[European Council For Nuclear Research]

THE FERMI INTERACTION IN β-DECAY. O. Kofoed-Hansen. Oct. 20, 1952. 9p.

2504 AEC-tr-2073

ON THE SHAPE OF THE FIRST FORBIDDEN BETA SPECTRA. Jeanne Laberrigue-Frolow and Roger Nataf. Translated by I. A. Warhett from J. phys. radium 15, 438-44(1954). 18p.

The correction factor for the allowed β^- and β^+ spectra to be applied in the case of the first forbidden transitions ($\Delta J = 1$, yes) was calculated for the pure T interaction for $Z = 5$, 35, and 50 and $E_{max} = 250$ and 500 kev; 1, 1.5, 2, 2.5, and 3 Mev. The shapes of the spectra differed little, in this case, from that of the allowed shape. Also given, with different values of these parameters, are values of expressions which will permit the calculation of the correction factor for any interaction particularly of the type (S,T). (auth)

2505

INTERNAL AND EXTERNAL BREMSSTRAHLUNG ACCOMPANYING THE BETA RAYS OF P^{32}. K. Lidén and N. Starfelt (Univ. of Lund, Sweden). Phys. Rev. 97, 419-27(1955) Jan. 15.

The spectral distribution and the total energy of the internal bremsstrahlung of P^{32} were measured from 20 to 1000 kev with a NaI(Tl) scintillation spectrometer. Special care was taken to diminish and correct for bremsstrahlung from the apparatus and the surroundings. The experimental curve agrees with theory from 20 to 50 kev and in the region 50 to 120 kev shows a weak bump in a smoothed curve; from 120 to 500 kev the curve lies 15 percent, at 800 kev 45 percent, and at 1000 kev 70 percent above a theory based on allowed β transition; thus, above 120 kev, the experimental curve disagrees with the theory for both allowed and forbidden β transitions. The total energy per β decay in the internal bremsstrahlung was found to exceed the calculated value by 21 percent. Using the same experimental arrangements the external bremsstrahlung emitted when the P^{32} β rays are completely stopped in carbon, aluminum, iron, tin, and lead was also measured. For light elements the observed spectrum was found to agree closely with the theory by Bethe and Heitler as improved by Elwert, but for heavy elements and high energies to exceed the calculated values considerably, e.g., for lead at 500 and 1000 kev by a factor of 1.4 and 2.0, respectively. (auth)

2506

BETA SPECTRUM OF C^{14}. A. V. Pohm, R. C. Waddell, J. P. Powers, and E. N. Jensen (Iowa State Coll., Ames). Phys. Rev. 97, 432-3(1955) Jan. 15.

A uniform thin source enriched with C^{14} was formed by vacuum evaporation of metallic lithium which was subsequently exposed to water vapor and carbon dioxide. The Kurie plot shows no deviation from linearity above 7 kev. The maximum energy of the beta spectrum was found to be 158.5 ± 0.5 kev. (auth)

2507

RADIOACTIVE DECAY OF Cs^{134} AND Cs^{134m}. G. L. Keister, E. B. Lee, and F. H. Schmidt (Univ. of Washington, Seattle). Phys. Rev. 97, 451-6(1955) Jan. 15.

The radiations of Cs^{134} (2.3 yr) and Cs^{134m} (3.15 hr) have been studied in a high-resolution beta-ray spectrometer. The gamma rays of Cs^{134} were observed both by internal and external conversion, and coincidence rates were measured between the beta continuum and the internal conversion electrons of the stronger gamma rays. The beta spectrum of Cs^{134} appears to consist of four, or possibly five, components. Nine gamma rays were found both by internal and external conversion; a tenth gamma ray appears only in internal conversion. A decay scheme is proposed which is reasonably consistent with the multipole order of each of the radiations as obtained from internal conversion data. A search was made for a ground- or intermediate-state beta transition from Cs^{134m}. No transition to the ground state was observed, but some indication was found for a weak transition to an excited state. (auth)

2508

β SPECTRUM OF Bi^{210} (RaE) AND THE COUPLING CONSTANTS OF SCALAR AND TENSOR INTERACTIONS IN β DECAY. G. E. Lee-Whiting (Atomic Energy of Canada Ltd., Chalk River, Ontario). Phys. Rev. 97, 463-8(1955) Jan. 15.

It is shown that the only pure states of spin 1 having magnetic moments in agreement with the measured upper limit for Bi^{210} are $(h_{9/2}; g_{9/2})_{1-}$ and $(h_{9/2}; i_{11/2})_{1-}$. The former is inconsistent with the results of an analysis of the β spectrum of Bi^{210} with a linear combination of scalar and tensor interactions, while the latter is consistent. It follows from the acceptance of the correctness of the latter that the relative sign of the scalar and tensor coupling constants is positive. (auth)

2509

UPPER LIMIT FOR THE LIFETIMES OF EXCITED STATES OF Ni^{60}. Z. Bay, V. P. Henri, and F. McLernon (George Washington Univ., Washington, D. C.). Phys. Rev. 97, 561-3(1955) Jan. 15.

An upper limit of 10^{-11} second for the lifetimes of the two excited states of Ni^{60} following the beta decay of Co^{60} has been determined. The E_2 transition energies are 1.17 and 1.33 Mev. (auth)

2510

RADIATION DOSIMETRY OF RUBIDIUM-86. E. W. Emery (Univ. of Manchester, England), J. E. S. Bradley (Post-

graduate Medical School, London, England), and N. Veall (Guy's Hospital Medical School, London, England). Nature 175, 34(1955) Jan. 1.

Data are presented on the formation and decay scheme of Ru^{96}. (C. H.)

2511

THE HALF LIFE OF Cl^{36}. Rosalie M. Bartholomew, A. W. Boyd, F. Brown, R. C. Hawkings, M. Lounsbury, and W. F. Merritt (Atomic Energy of Canada Ltd., Chalk River, Ontario). Can. J. Phys. 33, 43-8(1955) Feb.

Cl^{36} was prepared by neutron irradiation of c.p. grade potassium chloride for 14 months in the NRX reactor. The disintegration rate of a purified sample of the irradiated material was determined by absolute beta counting with a 4π methane flow-type proportional counter. The number of Cl^{36} atoms in the sample was determined by gravimetric and mass spectrometric analysis. A value of $(3.08 \pm 0.03) \times 10^5$ years was obtained for the half life of Cl^{36}, assuming that the simple decay scheme is correct. (auth)

2512

BRANCHING RATIO IN THE DECAY OF POLONIUM-210 R. W. Hayward, D. D. Hoppes, and W. B. Mann. J. Research Natl. Bur. Standards 54, 47-50(1955) Jan.

Using a micro-calorimeter to determine the alpha-particle activity and a NaI scintillation counter of high efficiency to measure the gamma-ray intensity, the branching ratio of Po^{210} has been found to be equal to $(1.22 \pm 0.06) \times 10^{-5}$. This value is based on the assumption that the energy of the main alpha-particle group from Po^{210} is 5.301 Mev. In the calibration of the scintillation counter the angular anisotropy of the gamma rays from Co^{60} was found to be 1.164 ± 0.002. (auth)

2513

NBS RADIOACTIVITY STANDARDS. Natl. Bur. Standards (U. S.) Tech. News Bull. 38, 72-7(1954) May.

The program of research and development, aimed at producing standards of radioactive nuclides, engaged in by the National Bureau of Standards is reviewed. (C.H.)

2514

TABLES FOR SIMPLIFYING CALCULATIONS OF ACTIVITIES PRODUCED BY THERMAL NEUTRONS. F. E. Senftle and W. R. Champion (U. S. Geological Survey, Washington, D. C.). Nuovo cimento 12, Suppl. No. 3, 549-71(1954). (In English)

2515

THE β-γ ANGULAR CORRELATION OF CHLORINE 38. P. Macq (Universite de Louvain, Belgium). Bull. classe sci. Acad. roy. Belg. 40, No. 8, 802-7(1954). (In French)

A β-γ angular correlation is demonstrated for Cl^{38}. The proposed disintegration processes are discussed in light of these results. New data on these processes are presented. (tr-auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

2516

PARAMAGNETIC ABSORPTION IN SOME Gd SALTS IN PARALLEL FIELDS. N. S. Garif'yanov. Zhur. Eksptl'. i Teoret. Fiz. 25, No. 3, 359-63(1953). (In Russian)

The applicability of Shaposhnikov's theory (Dissertation, Moscow Univ.(1949)) and Gorter's empirical formula to the experimentally determined values of paramagnetic absorption in parallel fields at high frequencies (5.46×10^8 c/s) is checked. It is found that Gorter's formula does not describe the experimental curves at $\sim 10^9$ c/s; Shaposhnikov's simplified formula $\chi''/\chi_0 = (1-F)^2 p_3 \nu$ applies very well to curves $\sim 10^9$ c/s. The magnetic heat-capacity constant b/C is calculated to be equal to $\delta^2/0.41$, where δ is the half-width of the absorption band. This constant is 3.82×10^6 Oe^2 for $Gd_2(SO_4)_3 \cdot 8H_2O$. (Science Abstracts)

SHIELDING

2517 KAPL-1262

Knolls Atomic Power Lab.

SELF-SHIELDING FACTORS FOR INFINITELY LONG, HOLLOW CYLINDERS. J. Dwork, P. L. Hofmann, H[enry] Hurwitz, Jr., and E. F. Clancy. Jan. 10, 1955. 70p. Contract W-31-109-Eng-52.

Self-shielding factors for monoenergetic neutrons entering an infinitely long, hollow cylinder are calculated. The results are given as a function of various parameters. (auth)

2518 NDA-Memo-15C-63

Nuclear Development Associates, Inc.

PHOTONEUTRON PRODUCTION FROM C^{13}. H[erbert] Goldstein. Jan. 13, 1954. 6p. Contract AT(30-1)-862.

The (γ,n) process from C^{13} is considered in relation to possible applications to shields that are better attenuators of neutrons than of γ rays. The cross sections curve between 4 and 16 Mev is estimated from preliminary information, and it is concluded that the C^{13} (γ,n) reaction would be an important photoneutron source strength in shields containing C. (K.S.)

2519

PROTECTIVE WINDOWS. Ind. Eng. Chem. 47, 9A-13A (1955) Feb.

Shielding glasses and liquids for protective windows are briefly discussed, including suppliers, chemical and physical properties, compositions, effects of γ irradiation, design and construction, safety factors, and installation. (J.A.G.)

SPECTROSCOPY

2520 NYO-3974

Johns Hopkins Univ.

THE INFRARED SPECTRUM OF H_2 AND D_2 BETWEEN ONE AND TWO MICRONS. S. P. S. Porto and G. H. Dieke. [June 29, 1954]. 15p. Contract AT(30-1)-1447.

More than 2600 new lines have been measured in the emission spectra of H_2 and D_2 between 1.15 and 1.97 μ with lead sulfide cells and powerful discharge tubes. Most of the strong lines below 1.65μ belong to known band systems. Beyond this new and so far incompletely analyzed band systems become prominent. (auth)

2521 UR-380

Atomic Energy Project, Univ. of Rochester

THE MEASUREMENT OF DIFFUSE REFLECTANCE OF CLOTH AND SKIN SAMPLES. Leo J. Krolak and Thomas P. Davis. Jan. 24, 1955. 36p. Contract W-7401-eng-49).

The diffuse reflectances of various samples of cloth and excised pig skin were determined using a Coblentz type reflectometer which was constructed for use in the range 0.4 to 2.6 μ. It was necessary to make preliminary reflection readings on each sample, in the range from 0.4 to 0.7 μ, with a General Electric automatic recording spectrophotometer so that a correction factor could be de-

termined to correct for energy losses suffered in the hemispherical reflectometer. A modification was suggested on the basis of errors brought out in the technique used. (auth)

2522

ON DEPENDENCE OF RESOLVING POWER OF PRISM, GRATING AND REFLECTING ECHELON ON STATE OF RESOLUTION AND DETECTING INSTRUMENT. Om Prakash Sharma and Mahendra Singh Sodha (Allahabad Univ., India). Indian J. Phys. 28, 437-40(1954) Sept.

The variation of resolving power of a prism, grating, and reflecting echelon with the value chosen for I_{min}/I_{max} at limiting resolution is discussed for the characterestics of the stage of resolution desired and the detecting instrument. (auth)

2523

THEORY OF HYPERFINE STRUCTURE. Charles Schwartz (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 97, 380-95(1955) Jan. 15.

Considering the classical electric and magnetic interactions between atomic electrons and the nucleus, a representation of the hyperfine interactions is arrived at in terms of a multipole expansion of the field potentials. Treating these noncentral interactions in first order perturbation theory, the form of the general interval instructure is given and analyzed for the multipole interaction constants using Racah coefficients. Pertinent matrix elements for a single valence electron are calculated relativistically. Some second order terms of the dipole and quadrupole interactions are calculated as they affect the interpretation of the first order octupole interaction. In this work the effect of some electronic configuration interaction is taken into account. Finally the values of nuclear magnetic octupole moments expected according to different models are calculated and compared with the experimental data thus far collected. Generally the measured octupole moments are in as good agreement with the values predicted by the single-particle shell model as are the corresponding dipole moments. (auth)

2524

THE HYPERFINE STRUCTURE OF MERCURY EXTRACTED FROM NEUTRON-IRRADIATED GOLD. R. E. Bedford and A. M. Crooker (Univ. of British Columbia, Vancouver). Can. J. Phys. 33, 25-33(1955) Jan.

The hfs. of suitable lines excited in Hg extracted from several gold samples in different neutron fluxes has been photographed with a Fabry-Perot interferometer. As well as the strong lines due to Hg^{198}, weak lines are also observed for Hg^{199} owing to the Au^{198} capturing a neutron before the β decay. Using the measured ratio of Hg^{199} to Hg^{198}, $\tau = 2.69$ days, and the neutron fluxes we have determined for the Au^{198} capture cross section, $\sigma = (1.78 \pm 0.10) \times 10^4$ barns. (auth)

2525

HYPERFINE STRUCTURE OF YTTERBIUM. K. Krebs and N. Neikowski. Ann. Physik 15, 124-34(1954) Nov. (In German)

THEORETICAL PHYSICS

2526 CERN/T/ARE-1

[European Council for Nuclear Research]

ANGULAR MOMENTUM IN QUANTUM MECHANICS. A. R. Edmonds. Jan. 1954. 49p.

2527 CERN/T/CM-1

[European Council for Nuclear Research]

NOTES ON PROFESSOR C. MØLLER'S LECTURE ON PSEUDOSCALAR MESON THEORY. Oct. 1952. 29p.

2528 CERN/T/GL-5

European Council for Nuclear Research

ON SOME SYMMETRY OPERATIONS IN QUANTUM THEORY. (LECTURE NOTES). Gerhart Lüders. Mar. 1953. 23p.

2529 CERN/T/KA-1

European Council for Nuclear Research

THE CONSEQUENCES OF THE CHARGE INDEPENDENCE IN MESON PHYSICS. Kurt Alder. Mar. 1953. 6p.

2530 CERN/T/LM-2

European Council for Nuclear Research

CONFRONTATION DE L'HYPOTHESE DE L'INTERACTION UNIVERSELLE DE FERMI AVEC L'EXPERIENCE. (Comparison of the Hypothesis of the Universal Fermi Interaction with Experiment). Louis Michel. June 1953. 87p.

2531 CERN/T/NMH-1

European Council for Nuclear Research

THE TAMM-DANCOFF METHOD IN CONFIGURATION SPACE. N. M. Hugenholtz. June 1954. 17p.

2532 CERN/T/RH-1

European Council for Nuclear Research

THE RELATIVISTIC QUANTUM THEORIES OF INTERACTING PARTICLES. Rudolf Haag. Nov. 1953. 75p.

2533

DISINTEGRATION OF THE DEUTERON BY ELECTRON BOMBARDMENT. V. A. Myamlin. Doklady Akad. Nauk S.S.S.R. 99, 377-80(1954) Nov. 21. (In Russian)

Theory of the process, various interactions being assumed, is developed. (G.Y.)

2534

INTERACTION OF NEW-TYPE SPIN-½ PARTICLES WITH EXTERNAL FIELD. Yu M. Shirokov (Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 99, 737-40(1954) Dec. 11. (In Russian)

The author has recently discussed (NSA 8-4178) a new class of relativistic equations for elementary particles in which the wave function for particles of spin s has $2s + 1$ components. Of greatest interest is the case $s = ½$, for which the wave function has two components and represents spin-½ particles without antiparticles (e.g., nucleons without antinucleons). Finite Lorentz transformations, bilinear invariants, and interaction with external fields are investigated for these new-type particles. (G. Y.)